Traction Guidebook

FOR MODEL RAILROADERS

$3.50
12022

- Modeling articles
- Prototype data
- Layout designs
- Equipment plans
- Model pikes

EDITED BY MIKE SCHAFER

Robert Carlson

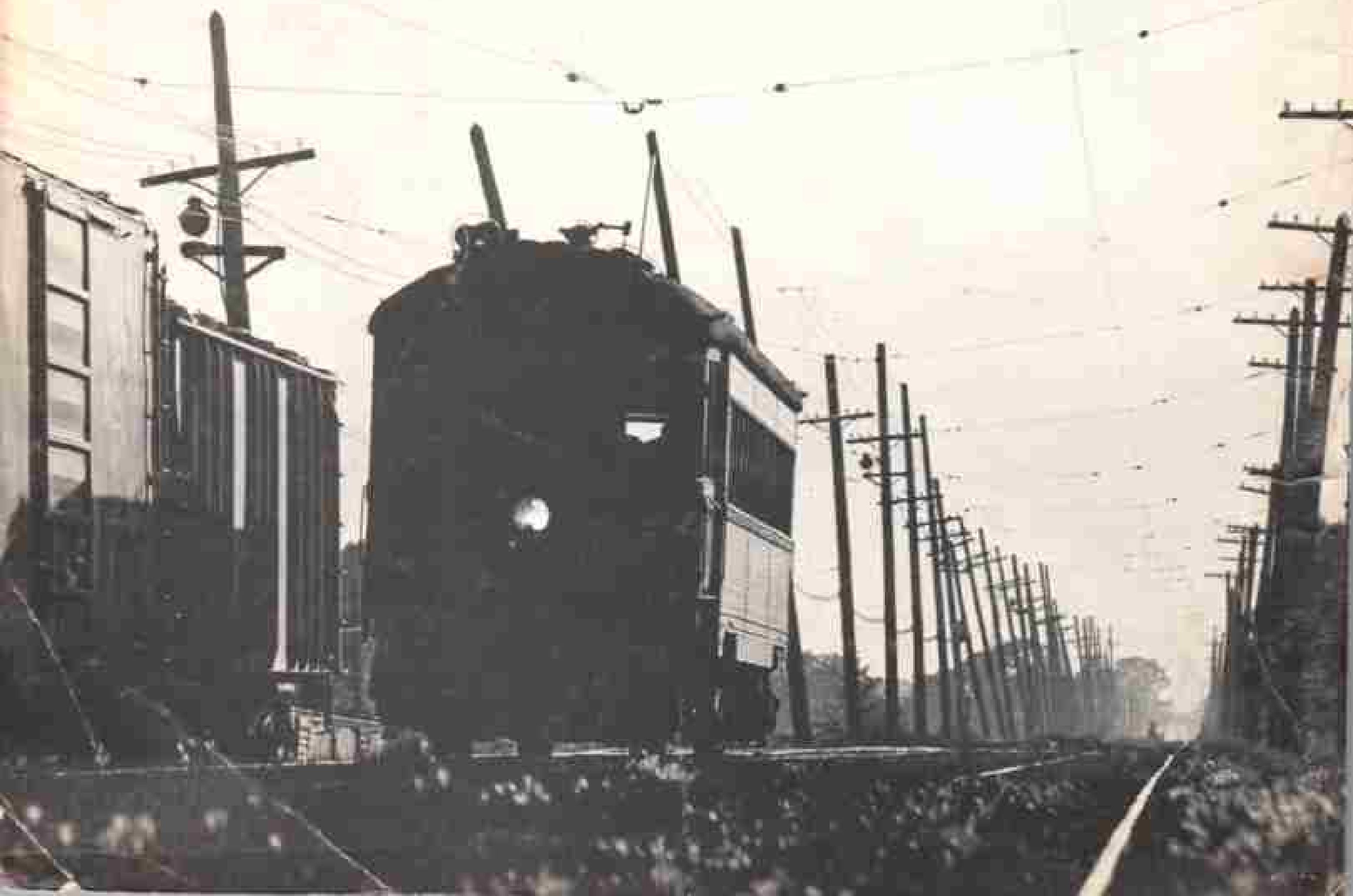
Donald Sims

FORGET for a moment that North Shore interurbans no longer race between Chicago and Milwaukee, and that owl-eyed Pacific Electric express cars have ceased to deliver goods to the population of Los Angeles, or that Illinois Terminal's electric streamliners were put to rest in a scrap yard. The interurban era has long since drawn to a close, but *you* can make history repeat itself . . . on your own model traction layout.

The TRACTION GUIDEBOOK FOR MODEL RAILROADERS provides valuable information about modeling the world of interurbans and streetcars. In this book you will find construction articles, track plans, and even "tours" over layouts of other traction modelers. And because the *prototype* (the actual thing) often is the best teacher, TRACTION GUIDEBOOK contains a wealth of prototype material — photographs, articles, equipment plans, and visits to real interurban lines.

MODEL RAILROADER magazine once stated that traction couldn't be beat when it came to wedging as much model railroading into a given space as possible. Interurbans can round curves sharper than any diesel can negotiate; streetcars can do twice as well. A single powered car constitutes a train, thus costs are lower for a given amount of operating fun. So, whether you plan to construct a model traction empire rivaling that of the huge Pacific Electric, or just add a small traction short line to your present steam or diesel layout, the TRACTION GUIDEBOOK will be a useful addition to your railroad library.

John Gruber



Traction Guidebook

FOR MODEL RAILROADERS

Edited by Mike Schafer

COVER SCENE: An Illinois Terminal motor express car and two trailers clatter through serene Midwestern countryside on a warm summer day in the 1930's. In reality, the cars are ¼" fine-scale models built by William J. Clouser of St. Louis, Mo. The sky and background (and the fly on the crossarm of the first pole) are real, and Clouser photographed this diorama in 1973.

COVER AND BOOK DESIGN: Lawrence Luser

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John P. Scharle

■ PROTOTYPE IN RETROSPECT

The Lehigh Valley Transit

Perhaps the sturdiest interurban of the Northeast, the Liberty Bell Line operated on sides of roads, private right of way, and rapid transit trackage

William D. Middleton

A southbound two-car LVT trolley freight (left) swings off private right of way to follow the highway (left out of photo) at the summit of Lehigh Mountain near Allentown in 1951. Note the use of semaphores with blades that point inward, a practice trolley lines followed so poles would not obscure signals. Also note the wood conduits for carrying wires between the signals and the tracks. Metal devices between the rails are induction coils to pass d.c. propulsion current from one block to the next without short-circuiting a.c. signal circuits. Wires near top of pole are power lines and phone and signal wires. Heavy lines on lowest crossarm are power feeders to trolley connections every few hundred feet.

View of the Philadelphia & Western shops near 69th Street shows the wye used to turn LVT's single-ended equipment, such as the Liberty Bell Limited being turned in the photo. Note the breaks in the third rail at turn-outs, and also the small platforms that enabled crewmen to descend from high-platform cars to throw switches if the switchtender was not on duty.

BY WILLIAM D. MIDDLETON

AS a prototype for modeling, it is hard to find any other interurban line in the Northeast that had as much variety of right of way and operation as the Lehigh Valley Transit. This line began as a side-of-the-road trolley and progressed until part of the system was operating on a rapid transit high-platform route with third rail. Yet to the end of its existence, the Allentown end of the line terminated in the city streets.

Through the years the cars were built and rebuilt to match the ever-changing needs of traffic and the threats of competition. Here alone is a page for your modeling notebook — the idea of making your own equipment look like it was rebuilt to accommodate changing business patterns. To see how changes affected the design, let us start with the LVT's beginnings.

How it came about

The Lehigh Valley Transit Co. was located in the "Pennsylvania Dutch" country of eastern Pennsylvania, with headquarters in Allentown. The LVT operated the local city car lines, as well as those in neighboring Bethlehem and Easton, and suburban and interurban routes in almost every direction from Allentown. At the turn of the century LVT's rail empire was confined to the Allentown area, but the company had plans for a high-speed electric railway that would reach both Philadelphia and New York. The line never made it to New York, but by 1903 passengers rode interurban cars from Allentown to Chestnut Hill, where they transferred to surface cars of the Philadelphia Rapid Transit Co. for the ride into Philadelphia. For much of its length the trolley line followed the shoulders of historic Bethlehem Pike, over which the Liberty Bell had been hauled in 1777 to be concealed in Zion's Reformed Church in Allentown when the British Army occupied Philadelphia, hence the slogan "Liberty Bell Route."

A few years later the line was extensively rebuilt for high-speed operation, and in 1912 a branch was completed from Wales Junction to Norristown, where a connection was made with the newly completed high-speed, third-rail Philadelphia & Western. Late in the year through operation was inaugurated from Allentown to the P&W's 69th Street Terminal in Upper Darby, where passengers transferred to the wide-gauge Market Street elevated line of PRT.

To operate its new service LVT bought a dozen handsome wood and steel interurbans from the Jewett Car Co. — LVT's 800 series in the numbering scheme. The cars were capable of better than mile-a-minute speeds, and trucks of some of them were fitted with roller bearings. They included such details as leaded "cathedral glass" in the arched upper window sections, tiled lavatories, solid inlaid mahogany woodwork, bronze fittings, and light blue ceilings. The main compartment was fitted with green plush walkover seats, while smoking section seats were covered with more durable black leather. Two of the cars were specially fitted with leather-upholstered mahogany club chairs. Smoker furnishings included bronze match scratchers and polished brass cuspidors.

Travel time between Allentown and Philadelphia had been 4½ hours when the Chestnut Hill line was first opened but was cut to 2 hours 15 minutes with the use of the new cars over the high-speed route. Since running time was faster and round trip fares were a dollar cheaper than on competing steam trains, the interurbans soon were handling most of the passenger trade.

A few years later, in 1916, LVT purchased another dozen cars from the Southern Car Co. for local interurban service. They had vestibule doors at each end for loading at the P&W's high-level platforms, as well as big center entrance doors for street loading. Numbering ran from 700 up.


Aaron G. Fryer

Rebuilds and color schemes

During later years LVT shops went through a bewildering series of rebuilding jobs on the two batches of interurbans. Some of the center-entrance cars were entirely rebuilt into conventional end-entrance cars, while others simply had the center doors covered over, leaving the conspicuous drop-center sides in place. In time most of the cars were converted for one-man operation. The original LVT color scheme of chrome green bodies, chrome yellow roof, and gold striping later was replaced by varying shades of red with tan or silver roofs and silver striping.

During the 1920's some of the cars were converted to de luxe chair cars for service on the *Philadelphian* and *Allentonian* limited trains, which were operated twice daily in each direction. Passengers paid only 50 cents, later reduced to a quarter, to ride the plush parlor cars. When automobile competition began to cut into LVT's interurban revenues in the early 1930's, the company fought back by converting some of its cars for "de luxe limited" service. Extensive structural modifications were made to the cars and motors were rewired for 70 mph speeds. New seats and window curtains were installed, and a lounge section, complete with sofa, card table with checkerboard, ashtray, table, and individual leather seats, was provided at the observation end.

Like most interurbans, LVT went in for the special excursion business. Outings to Atlantic City and other seaside resorts, and Delaware Bay steamer excursions were popular attractions in the earlier days. By means of connecting trolley lines, LVT was able to offer service to the scenic Delaware Water Gap, 90 miles north of Philadelphia. The company's publicity film, *A Honeymoon Trip to Delaware Water Gap*, was widely shown in 1941 to stimulate traffic along this route.

The C&LE cars

The most radical change of all in LVT interurban equipment came in 1939, when the company went shopping in the secondhand equipment market and came up with a batch of Cincinnati & Lake Erie's famous high-speed cars, some of the finest interurbans ever built.

Let us look back in interurban history to the development of these cars. The C&LE system had been formed in 1928 by the consolidation of several Ohio lines, and the company's energetic president, Dr. Thomas Conway Jr., set out to develop a lightweight interurban car capable of extremely high speeds that would give a vastly improved service over the rejuvenated C&LE system. Extensive tests were carried out in conjunction with car builders and equipment suppliers, and a design for the radical new cars was evolved. Liberal use of aluminum was made in the car bodies, and the builder, Cincinnati Car Co., developed smooth-riding low-level trucks which incorporated four motors of a new 100 h.p. design perfected by GE and Westinghouse, capable of speeds in excess of 90 mph. As a publicity stunt, C&LE car 126 raced against, and defeated, an airplane.

Even new equipment and vastly improved service could not stem the loss of C&LE's passenger business to private autos, and by 1938 the line was abandoned and the high-speed cars were looking for a new home. They were just what LVT needed to pep up its own interurban passenger business, which had

Fielding L. Bowman

LVT No. 1030, an ex-Indiana Railroad lightweight car, sails along the old main road between Quakerstown and Perkasie, Pa. The rolling hills and trim farms of Bucks County were typical of the Pennsylvania Dutch country LVT served through the years.

Richard E. B. Parker

A Philadelphia express loads passengers at the Lansdale (Pa.) station. In the background is Reading Company's depot. In many ways, Reading's Philadelphia-Bethlehem line (partly electrified) was competitive with the LVT, for it paralleled much of LVT's route and offered no-change service to downtown Philadelphia; LVT patrons had to change at 69th Street, and, after 1949, also Norristown. On the other hand, LVT had many diverse bus, streetcar, and rapid-transit connections at 69th Street enabling people to travel to sections of Philly other than downtown.

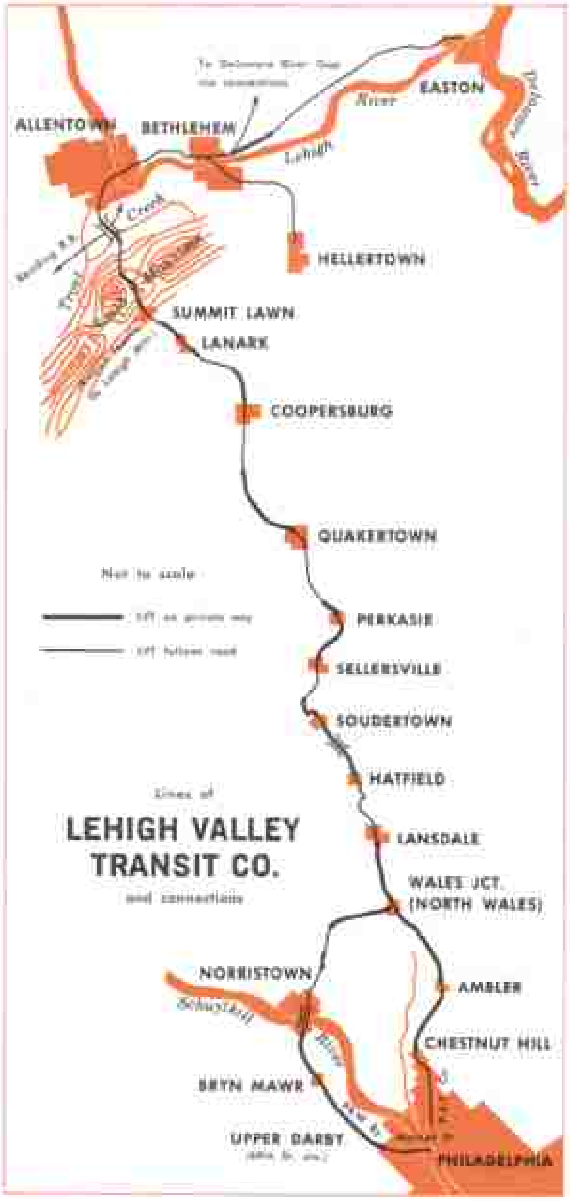
At Allentown cars simply terminated in the street. Rear-end view of LVT 1006, a former C&LE lightweight car, shows the trolley pole reversed for wyeing the car in preparation for a Liberty Bell Limited run back to Norristown. Note the depot sign and the asphalt-patched brick street in this 1950 scene.

MODEL RAILROADER: Linn H. Westcott

A southbound LVT car from Allentown leaves street running and enters Philadelphia & Western's elevated station in Norristown. Beyond this station LVT cars used P&W's high-speed right of way to 69th Street. After 1949, LVT cars terminated here and passengers transferred to P&W cars.

Richard H. Young

A railfan special trundles along the LVT near Souderton, Pa., in May 1950. The first two cars are converted center-entrance cars; the center-door location on the second car still is evident.



Both photos, William D. Middleton.

Freight motors C15 and C7 (above) were converted interurban cars. These two cars, on the morning of February 3, 1950, made up the southbound package freight consist through Souderton on the Liberty Bell Route.

Northbound car 1023 (right) crosses trestle over Trout Creek meadow and the Reading Railroad near South Allentown. Look carefully — the trolley wire is actually two wires strung close together. This sometimes was done to provide better current feed for short distances, or to equalize wear, or to avoid wire frogs where double track became single or gauntlet track for short distances.

declined 68 per cent over a 10-year period. Thirteen of the cars were purchased and extensively remodeled for *Liberty Bell Limited* service over the Allentown-Philadelphia line.

Exteriors of the cars were finished in a striking "picador cream" color, with "mountain-ash scarlet" trim. Roofs were painted aluminum, pilots sheathed in stainless steel, and chromium-plated air horns, grab handles, and automotive type spotlights were installed. The decorative touches extended to the wheel tires, which were painted white. The cars were numbered from 1000, and 1002 was old 126, the race car.

Interiors were finished various shades of tan, brown, and green, and seats were covered with leather or mohair which harmonized with the interior color. Seven of the cars had club compartments at the observation end, which were furnished with comfortable chairs, sofas, and writing tables. Linen towels with an embroidered Liberty Bell emblem were provided for the headrests.

At the same time, LVT acquired four of the Cincinnati Car Co.'s curved-side "fishbelly" lightweight cars from the defunct Dayton & Troy Electric Railway in Ohio for Easton Limited service on the Allentown-Bethlehem-Easton interurban line. These cars received a similar refurbishing job, except that exteriors were finished in scarlet with cream trim. They were numbered from 1100.

Two years later one of the Indiana Railroad's high-speed lightweights was acquired and similarly overhauled. This car was similar in appearance to the C&LE cars but was rounded at the rear. As LVT No. 1030 the car was equipped throughout with lounge furniture. One of its de luxe features consisted of a miniature hanging garden on one wall, complete with sansevieria and philodendron plants. The Indiana Railroad trucks proved too large for application of the third-rail shoes needed for operation over the P&W and were replaced with trucks from one of the C&LE cars which had been destroyed the year before in a spectacular fire.

To supplement the new lightweights, LVT retained a number of the older heavyweight cars, and in later years many of these were refinished in the

same cream and scarlet colors applied to the lightweights. Local business over the interurban line, particularly over the southern end, was heavy and during the later years of operation a group of former Steubenville (Ohio) suburban cars were usually used to supplement the through interurbans.

A trip over LVT's scenic Philadelphia Division Liberty Bell Route incorporated just about every conceivable type of interurban operation. For the first 13 miles out of the 69th Street Terminal the *Liberty Bell Limited* zipped over the double-track third-rail P&W, which has often been described as a "super interurban." Extensive cuts and fills were employed in construction of the P&W to permit high speeds despite the hilly countryside through which it operated. The P&W was built without a single grade crossing with either highways or other railroads. The most spectacular feature of the line was the 3850-foot steel bridge that carried the cars over numerous steam railroads, several canals and the Schuylkill River into the elevated Norristown terminal.

At Norristown LVT cars struck out over their own line, going immediately to street level and later onto private right of way. The route passed through such trim communities as Lansdale, Sellersville, Perkasie, Quakertown, and Coopersburg. Often the cars made their way on the streets of the cities and towns along the way, but at some towns the line sliced through on its own right of way. Sometimes the single-track line still followed highways in roadside trolley tradition as it was originally built, but more often it headed off on its own over the Pennsylvania countryside.

Despite some severe grades, the line was well graded and ballasted and the cars were able to make mile-a-minute or better time. Catenary construction was employed for much of the trolley wire, and block signals were installed throughout. Much of the overhead construction and many of the bridges were designed to permit two tracks, but double-tracking never took place. Among the more spectacular structures on the route were high steel trestles, one between Hatfield and Souderton and another over Trout Creek meadow and the Reading Railroad at South Allentown. Just south of Allentown the cars climbed uphill to the crest of Lehigh Mountain at Summit Lawn, then hurtled down the north slope into downtown Allentown.

Most Keystone State interurbans were built to the 5'-2½" or 5'-3" "Pennsylvania broad gauge," which effectively prevented interchange with steam roads. This killed off many early lines in Pennsylvania, but the LVT was built to standard gauge and did not have this particular problem. However, steep grades and sharp curves in city streets were just as effective in ruling out carload freight traffic. Consequently, LVT built up an extensive package freight business, using special freight cars, that operated from Easton, Bethlehem and Allentown into a freight station at the P&W's 69th Street Terminal.

Originally, flat-roofed wooden freight motors were used in the service, but when the arrival of newer cars made many of the older Jewett interurbans surplus, they were converted into "trolley freight" cars and renumbered. Two- and three-car trolley freights were usually operated over the line several times a day. Before the arrival of the lightweight interurbans, which could not be operated in multiple unit, freight cars often were combined in trains with passenger cars.

Loading and unloading provided special door problems on the LVT. The lightweight cars were built so one man could handle both operation and fare collection, and quick unloading was not necessary. Thus there was no need for doors at the rear of the car. Some of the older cars had their rear doors blocked off in later years.

On the P&W the platforms were high in the manner of a subway or elevated line. On the rest of the LVT loading was from curb or even street pavement. Therefore, there had to be both a step well and a flop-down trap door over the well. Furthermore, at some stations loading had to be at the left side of the car. For instance, the loading was from the curb at the side of the street in Lansdale. In Norristown the P&W terminal was a one-track elevated station with a high platform only on one side of the track. At these stations and others like them the motorman stepped aside to let the passengers use the left front door.

In trackwork this single-ended operation also produced its problems, and wyes were installed at a number of places so a car could be turned to go the other way. This required backing a short distance and a trolley pole at the front of the car.

Because LVT interurbans used a sliding shoe for current collection, periodic lubrication of the trolley wire was required. A novel sight on the Liberty Bell Route was the monthly appearance of a specially equipped car which moved slowly over the line spreading a special grease on the overhead wire.

Despite the lack of heavy freight traffic (which helped so many interurbans to survive), LVT kept going for a remarkably long time after almost every comparable system had been abandoned. Through car service over Philadelphia & Western was discontinued in 1949, forcing passengers to transfer at Norristown. This move did not do anything to improve the already dwindling passenger traffic and in 1951 LVT finally folded up its famous Liberty Bell Route interurban line in favor of buses. The Easton Limited cars had met a similar fate two years before, and the company's many city car lines soon went the same way. Some of the equipment went to Milwaukee and Iowa lines.

David H. Cope

(Above) A southbound National Railway Historical Society special with No. 812 (former private car 999) meets an ex-C&LE car on northbound Liberty Bell Limited at Emaus Junction in 1949. (Left) Fresh from an overhaul, ex-Dayton & Troy interurban, built by Cincinnati Car Co., poses outside LVT's Fairview Shops in Allentown. LVT acquired four such cars for Easton Limited service between Allentown, Bethlehem, and Easton.

David B. Russell

Interurbans seemed to leave from nowhere. In Fort Dodge, cars simply looped around the station; the passenger loading "platform" was but a graveled area about the freight platform. Note Railway Express truck and the box car next to the station.

The Fort Dodge Line

Iowa interurbans outlived most others

BY WILLIAM D. MIDDLETON

IN Iowa the interurban lasted longer than in most other parts of the country or Canada. There was good reason for this — a reason that makes the Iowa electric lines particularly well suited to model railroad simulation. Unlike most other interurban railways, which were built primarily as passenger carriers in competition with steam railroads, the Iowa interurbans developed largely as shortline feeders to steam lines. As a result a more friendly relationship usually existed between them. A substantial interchange in carload freight traffic developed between the two; this greater emphasis on freight traffic became the principal contributor to the long life of the Iowa interurbans.

Most of the lines began their history during the boom that swept the country early in this century, but some were electrifications of what had been, at least in part, steam short lines. Thus, even more certain steam-road characteristics were carried into the traction systems.

The largest, and one of the most interesting, of these Iowa "steam road" trolleys was the Fort Dodge, Des Moines & Southern Railway, usually known by its slogan "The Fort Dodge Line." It operated 147 miles of electric line in the very center of Iowa. Although no longer electrically operated, the system is still in business as a dieselized freight-only line.

Fort Dodge Line growth

The original portion of what was to become the Fort Dodge system was only 3 miles of track opened in 1893 from the coal mines at Fraser — on the Des Moines River near Boone — to a connection with the Minneapolis & St. Louis at Fraser Junction, now called Wolf. A little later another company acquired the line with the idea of extending it into South Dakota. Eighteen miles of track were built north-northwestward to Gowrie, using 60- and 70-pound rail.

The coal business was good, but railroad extension was not that simple. Another company acquired the property in 1902. Track was extended, and by 1905 the company, then known as the Newton & Northwestern Railroad, was operating 102 miles of railroad extending from Newton in an almost-straight diagonal line northwest to Rockwell City. Its principal business was still hauling coal. At this time the roster included 5 locomotives, 45 coal cars, 2 combination cabooses, and 2 passenger cars. Two trains ran each way daily except Sunday.

The FtDDM&S itself appeared in 1906. With New England financiers behind it, this new company acquired control of the Newton & Northwestern. It also acquired the local street railway system in Fort Dodge and a 2-mile-long steam-dummy line operating between Ames and Iowa State College.

A 2.5-million-dollar electrification program promptly was launched. For power, a steam-turbine-driven power plant, operating on coal from company-owned mines, was built at Fraser. A new 25-mile electric line was built south from Midvale to reach Des Moines. Another line, 22 miles long, was built north from Hope to Fort Dodge. Trolley wire was strung over the intervening 38 miles of existing steam line.

Late in 1907 fast interurban passenger service was inaugurated over the 85-mile route between Des Moines and Fort Dodge with 10 handsome wood interurban cars received from the Niles Car Co. Another 7 miles of electric line was built from a new junction at Kelley to Ames. Passenger service on the nonelectrified portion of the system, as well as freight

Basil W. Koch

R. D. Kimmel

The most spectacular spot along the Fort Dodge Line is not a crossing of a river, but rather of an unimportant tributary that interupts the railroad's steady climb to reach Boone. Car 62 (above right) crosses the span in a view that looks toward Boone.

service on the entire railroad, operated behind steam power.

The expense of electrification threw the new company into bankruptcy in 1910. The receivers endeavored to increase the line's already-substantial freight business in order to improve earnings. One of the first steps was to convert from 600-volt electrification to 1200 volts d.c.* to provide more adequate power for the operation of heavy electric freight trains. The original passenger cars were re-equipped to permit operation on the higher voltage, and steeplecab electric locomotives were ordered from General Electric for freight service. Part of the original Newton & Northwestern line from Midvale to Newton was abandoned in 1912. The remaining steam-operated section from Hope to Rockwell City was electrified at this time, making the Fort Dodge Line all-electric.

In 1916 the railway extended its operations into important new territory with the purchase of the Crooked Creek Railroad, a steam short line between Webster City and Lehigh. The CC had begun operation in 1875 as a 3-foot-gauge coal carrier. A route running beside a Chicago Great Western branch provided a connection to it from the FtDDM&S main line at Fort Dodge. The new line provided the Fort Dodge Line with access to one of the largest gypsum-producing areas in the U.S.; this has provided the railroad with its largest single source of freight traffic ever since.

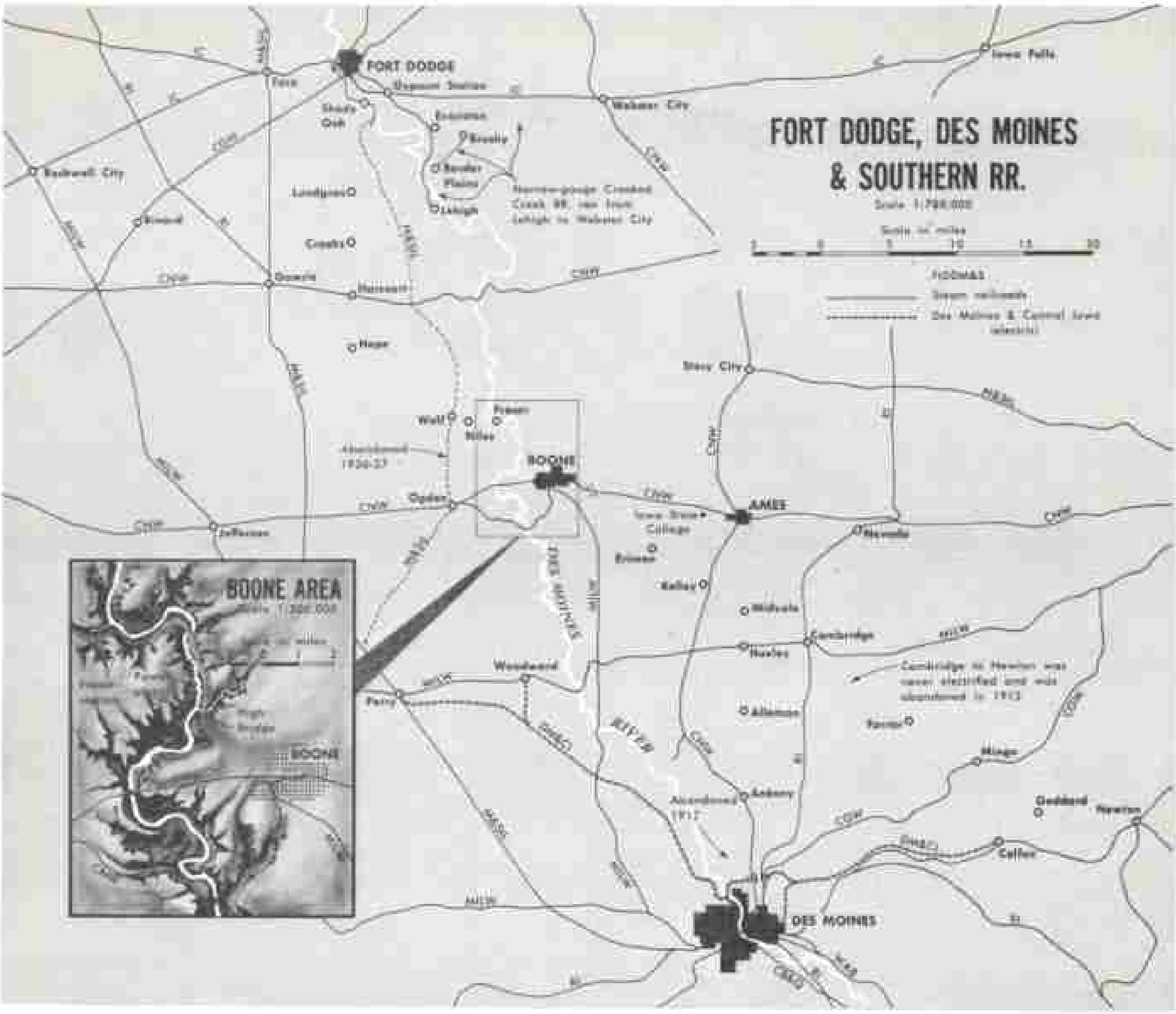
Most of the Fort Dodge Line was built to the high standards of steam railroads, but many of the characteristics common to interurbans also were to be found. At Des Moines the cars initially entered the city over the tracks of another interurban, the Inter-Urban Railway — later the Des Moines & Central Iowa. Later, the Fort Dodge Line obtained a new entrance into Des Moines, making use of Rock Island trackage. The passenger cars then operated directly into the Rock Island station. Still later a connec-

*The advantage of using a higher voltage was that less current flowed through the wire and feeders for a given power load. With voltage doubled, current was cut in half. This meant voltage losses were also cut in half — actually half of half, percentagewise. Thus power loss was only one fourth as much as with the original 600-volt line. The Fort Dodge Line was an early user of this efficiency principle, but soon afterward, 3000 volts as on the Milwaukee Road and 22,000 volts as on the Detroit, Toledo & Ironton carried this principle further. Today the use of 500 to 600 volts is confined mostly to street railways and local rapid-transit systems. The Long Island is the longest other user, at least in the U.S.

Don Smith

William D. Middleton

It's the day after Christmas in 1949, and car 82 (above), operating as southbound train No. 4, departs Boone. Winter operations on the FtDDM&S meant equipping cars with snowplows to forearm against sudden Midwestern blizzards. At Boone station (right) the right of way was barely wide enough for track and poles. Boone, a division point and location of the railroad's shops, was exactly halfway along the main line between Fort Dodge and Des Moines.



tion was built near the state capitol with the Des Moines Street Railway, and the Fort Dodge interurbans began operating through city streets to reach a joint terminal with the Des Moines & Central Iowa. Finally, when street operation was given up, and until the end of passenger service in 1955, the cars terminated at a small station at the foot of Capitol Hill.

At the north end of the line, too, the cars ran through streets in typical interurban fashion. Since the FtDDM&S operated the local street railway in Fort Dodge, the company's interurbans ran over the local tracks for several blocks to reach their terminal. In 1941, street running was given up, the cars terminated at a station at the end of the private right of way.

Through the cities and towns between these two terminal cities the Fort Dodge Line had its own right of way. Thus the operation of heavy freight trains was never hampered by street running, as it was on so many interurban systems.

Geography

Much of the country traversed by the Fort Dodge Line is the gently rolling fertile farmland typical of Iowa; but northwest of Boone, where the line drops down into the Des Moines River valley, crosses the river, then climbs out of the valley, the railroad encounters some unusually picturesque and rugged terrain.

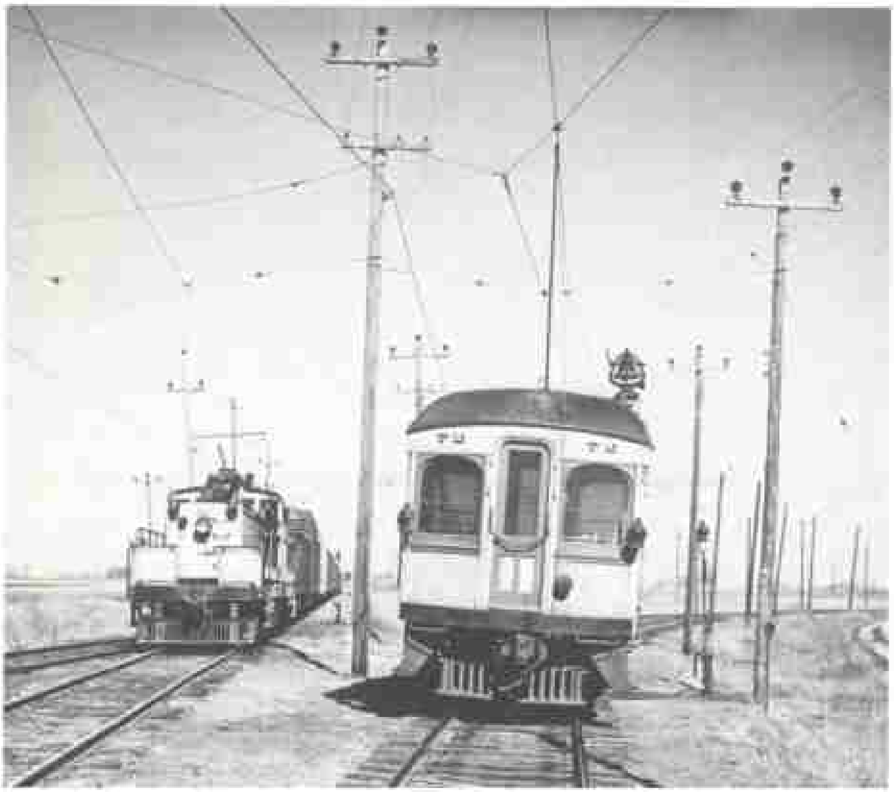
Approaching this area a few miles from Boone, builders of the original Newton & Northwestern steam line were confronted by a deep ravine leading to the river valley. They spanned it with a spectacular timber trestle 156 feet high and 784 feet long. A million board feet of timber went into its construction. The trestle lasted until 1912, when a flood washed out the center section. A crew of 12 men worked 70 days constructing a new steel viaduct parallel to the original span. It was logically known as High Bridge, and it was the highest bridge ever built on an interurban railway. It is still in service.

North of High Bridge, Fort Dodge Line rails descend into the valley, cross the Des Moines River near the company's Fraser powerhouse, and climb out of the valley on a 2-mile, 2.5 percent grade to the crest at Niles. The railroad recrosses the river a few miles south of Fort Dodge on a massive steel deck truss.

The Fort Dodge Line retained a few traces of its steam-road origin even into comparatively recent years. At the Boone shops, center of the line's operations, a battered wooden roundhouse that once housed Newton & Northwestern locomotives and an old turntable used daily to run single-ended interurbans were kept in service. Another Fort Dodge Line roundhouse, originally used by the old Crooked Creek Railroad, stood in Webster City for many years.

Passenger service

Passenger-train service on the Fort Dodge Line was moderately frequent during the peak years of interurban operation. In 1916 the company offered an hourly service over the main line between Des Moines and Boone. Cars departed every second hour for points north of Boone. The Webster City


William D. Middleton

The junction at Hope was a handy place to schedule meets between passenger and freight trains. Locomotive No. 362 was a 16-wheel locomotive originally used by Oregon Electric.

branch, as well as the main line, had passenger service. Shuttle cars operated on the Ames and Rockwell City branches, meeting all mainline trains. The company also operated local streetcar lines in Fort Dodge and Ames.

Passenger traffic dwindled rapidly after the development of the automobile and good roads. By the end of the 1920's FtDDM&S had discontinued all branchline and local streetcar services. Mainline schedules were reduced to four round trips daily. Scheduled service was reduced to two daily round trips in the early 1950's. In the last year before passenger service was entirely abandoned in 1955, only one daily round trip was operated. The routing was unusual: Starting from the line's headquarters at Boone in the morning, a single car operated north to Fort Dodge, then southward over the entire main line to Des Moines, and finally north again as far as Boone. Passengers were almost nonexistent during the last few years; the cars were operated principally for the accommodation of deadheading freight crews.

The 10 big combination baggage-passenger cars delivered for the original Fort Dodge Line passenger electrification in 1907 were handsome wood cars typical of the distinguished interurban car architecture of their builder, the Niles Car Co. The 53-foot, 37-ton cars were given even numbers only, from 64 to 82. They were provided with graceful arched windows fitted with colored art glass in the upper sash. Interiors were beautifully finished in mahogany and furnished with leather-upholstered seats.

Although the cars' appearance originally was typical of the passenger stock operated by many other interurban systems, numerous modifications in the company shops gradually transformed them into highly distinctive equipment. The original clerestory was replaced with an arch roof. The arched upper window sash was replaced by a rectangular section; a few windows on each side were blocked off. Another distinctive change to the cars was the installation of a steel reinforcing channel along the bottom of each side. Deeper truss rods replaced the original rods.

The most impressive feature of Fort Dodge Line interurbans was their front-end appearance. A massive headlight was hung high in the train-door opening. A destination sign was mounted below the right-hand window, and a train number indicator, unusual for an interurban, was mounted on the opposite side. An air horn and the large locomotive-type bell were mounted on the roof above the left-hand motorman's cab (the bell was typical of most Iowa interurbans). During winter months a big sheet steel snowplow was mounted over the heavy wood pilot. Although the cars normally were operated only in one direction, they were equipped with a pilot, bell, air whistle, and controls at the rear end, and an extra trolley pole at the front end. These permitted backup operation. Multiple-unit controls permitted operation of the cars in trains.

Other distinctive features of the cars included an unusual oval washroom window near the center on the left side, and a big smokejack on the roof for the coal-burning car heater. Until operation on Des Moines and Fort Dodge city streets was discontinued, the cars were equipped with screens or bars across the lower section of the windows. An unusual feature of the cars during the first few years they were in operation was the installation of both a standard steam-road-type MCB coupler and a Van Dorn coupler (widely used by interurbans) at each end.

Color schemes for the Fort Dodge Line interurbans changed several times during their half-century life span. Originally they were finished in standard Pullman green. This was later changed to a dull boxcar red; and finally — around the end of World War II — the cars appeared in bright canary yellow with medium green trim around doors and windows, and black roof, lettering, and underbody.

In 1916 the line received a combination passenger-baggage car from the American Car Co. to supplement the original 10 Niles cars in mainline service. Although similar in arrangement and in many details to the Niles cars, the new car — No. 62 — was unusual in other respects. The 57-foot car was of composite wood and steel construction with an all-steel underframe; it was steel-sheathed up to the window sill level. Above the sill, wood sheathing was applied. The most distinctive feature of the car was its extreme width of 9'-10" — over a foot wider than more typical interurban cars.

To operate its branchline services the company used four 42-foot center entrance combination baggage-passenger cars. The first two, Nos. 40 and 50, were wood, clerestory-roof cars built in company shops; the last two — 52 and 54 — were arch-roof wood-and-steel cars built by the American Car Co. and McGuire-Cummings.

To provide luxury service on mainline passenger runs, FtDDM&S purchased a handsome parlor-observation car, No. 38, from the Jewett Car Co. in 1912. The clerestory-roof wood car was operated as a trailer. It featured an inlaid mahogany interior, bronze chandeliers, high-quality Brussels carpeting, art-glass gothic arch windows, and a brass-railed rear observation platform. A similar parlor car, No. 36, but of arch-roof, steel construction, was purchased a few years later from McGuire-Cummings. The cars were operated twice daily in each direction on through trains between Des Moines and Fort Dodge. They were staffed by porters; a modest extra fare was charged: 25 cents.

A small fleet of single-truck cars served to operate the company's city services in Ames and Fort Dodge.

Other passenger equipment operated by the Fort Dodge Line included a num-

Both photos, William D. Middleton

Cab view (left) approaching Harcourt, where the FtDDM&S crossed a secondary route of the Chicago & North Western. (Above) After passing the junction with the branch from Webster City and Lehigh (where all the gypsum originated), the cars skipped over the Des Moines River on this deck truss bridge. Car 72, one of 10 delivered by Niles in 1910, was recorded here in 1955.

ber of former steam-railroad coaches used as interurban trailers. Company "brass" traveled over the line in No. 7, a former Wichita Falls & Southern Railroad business car. This car was scrapped about 1954 but was replaced by an 80-foot air-conditioned Pullman open-end observation car, the *Mount Foraker*, which took the same number.

Freight service

The Fort Dodge Line has always been primarily a freight carrier. Even in 1910, when interurban passenger traffic was near its peak, the line earned 60 per cent of its revenue from freight traffic. At one time the line was described as the heaviest freight-carrying electric interurban in the country. Freight cars were interchanged with every steam railroad crossed by the electric line; in 1910, FtDDM&S was interchanging an average of 500 cars monthly. This interchange traffic made the Fort Dodge Line such an integral part of the national steam-railroad network that it was one of the few interurbans operated by the United States Railroad Administration of World War I. The company has always owned a large quantity of standard freight cars. In 1918 it had no less than 2500 of them. Even in recent years the company has bought as many as 200 new boxcars in a single order.

Carload freight continued to operate behind steam after the original 1907 electrification of the line, although the company's original interurban equipment order from Niles did include a large wood box motor for handling small freight shipments. A few years later, McGuire-Cummings delivered a second box motor; this was equipped with a large removable nose plow so that it could double as a snowplow. Later, when the FtDDM&S began hauling all of its freight traffic with electric locomotives, the two box motors were converted to work equipment. The Niles box motor, after a portion of the body was removed and a telescoping tower was installed, became a line car.

The Fort Dodge Line received its first electric locomotives in 1909 when

Richard H. Young

Just as the line seemed to leave from nowhere, it seemed to end nowhere, too, at the outskirts of Des Moines. A scene like this might be common today if highways had not prevailed. Left to right: car 74, locomotive 207, and a FtDDM&S reefer.

Baldwin-Westinghouse delivered two standard 43-ton steeplecab locomotives. When the system converted trolley voltage to 1200 volts, these BW locomotives were re-equipped for operation on the higher voltage and five new 43-ton steeplecabs were purchased from General Electric. Both groups of locomotives were numbered in the 100 series.

In 1912, two General Electric 70-ton steeplecab locomotives were added to the roster. Two more GE locomotives, this time the boxcab type, were purchased in 1915; still another GE steeplecab was added in 1929.

In 1950 the line purchased a third-hand 60-ton McGuire-Cummings steeplecab. This was built in 1915 for the Waterloo, Cedar Falls & Northern. Later it was sold to the Iowa Transfer Railway, an electrified terminal system in Des Moines, before going to the Fort Dodge Line.

All of these heavier locomotives were numbered in the 200 series.

Freight traffic boomed on the Fort Dodge Line after World War II. To provide additional motive power for the growing tonnage, the company acquired three big 16-wheel electric locomotives from the dieselized Oregon Electric Railway. This was in 1947. These un-

Basil W. Koch

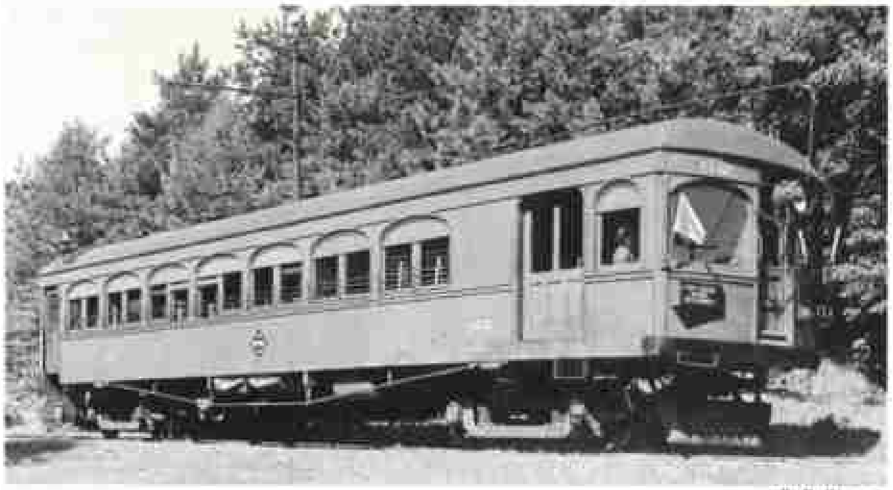
East of Boone the line vaulted over the double-track main of the C&NW — in typical interurban fashion — by means of a short fill. The three-car train is a 1954 railfan special.

R. D. Kimmel

Car 66 is a Niles product that arrived on the FtDDM&S in 1907 with nine sister cars. Originally No. 66 had a clerestory roof and graceful arch side windows, but through the years the shops modified the appearance of the old wooden cars of this series.

usual locomotives had been built in OE shops in 1942 and 1944, utilizing trucks and motors from scrapped passenger cars. To permit operation around short-radius interurban curves, their four power trucks were mounted under a pair of articulated frames. Cabs were isolated in the center with a long hood at each end, giving them the appearance of an elongated steeplecab locomotive. These powerful locomotives were capable of moving a 650-ton train up the line's 2-mile, 2.5 per cent Fraser Hill grade. This was well over twice the rating of the older steeplecabs. They were numbered in the 360 class.

In the late years the Fort Dodge Line freight locomotives were painted in the same bright yellow and green applied to passenger equipment. With the exception of the former Oregon Electric locomotives, which were numbered consecutively, and steeplecab locomotive No. 208, only odd numbers were assigned to FtDDM&S freight locomotives.



R. O. Kimmel

No. 62, the lone American Car Co. car on the roster (running extra as the white flags indicate) paused in the hot sunshine of a summer afternoon at Campus, near Ames, in 1940.

The latter years

Early in 1949 the Fort Dodge Line began a planned program for dieselization with the purchase of two 70-ton GE diesel-electrics. These were sufficient to dieselize the Webster City and Rockwell City branches. In June 1954, the Des Moines River went on a rampage that upset the Fort Dodge Line's dieselization timetable. The Fraser power plant was flooded, and for 4 months and 10 days the trolley system was without electric power. Passenger service was suspended. Five diesels, three of them borrowed from the Rock Island and the Minneapolis & St. Louis, managed to keep freight traffic moving. Oddly enough, this temporary dieselization helped prolong the electrification of the FtDDM&S. This was because the heavy expenses of repairing flood damage to the power plant and the track in the river valley forced the company to delay the purchase of the additional diesels needed to complete the program. Electric operation was resumed after repairs to the power plant were completed, and continued for almost a year. Passenger operation lasted until the end of August 1955; electric freight haulage gave way to all-diesel soon afterward.

In recent years the Fort Dodge Line was one of the many small lines owned by the Salzberg group, along with the Des Moines & Central Iowa, with which it connects at Des Moines.

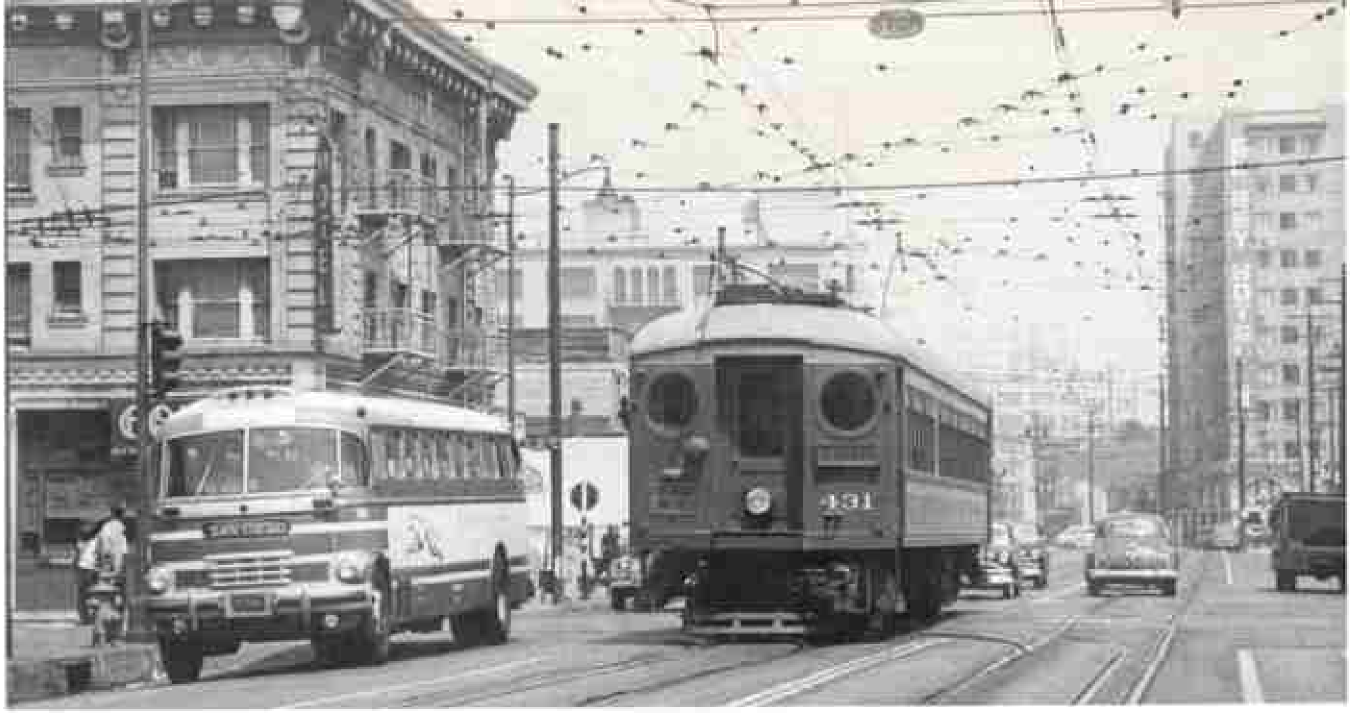
Today, both the FtDDM&S and the DM&CI are controlled by the Chicago & North Western Transportation Company.

Lloyd Goodeyon

The third series of electric locomotives bought by the Fort Dodge Line were four boxcab motors purchased from GE in 1912 and 1915. No. 207 was built in 1915.

William D. Middleton

Swinging westward in Des Moines (left), the Fort Dodge Line is crowded to the bluff by two Wabash tracks, five Rock Island tracks, and two Chicago Great Western tracks. Here No. 203, one of the 70-ton GE locomotives, is shoving some cars onto an interchange track. No. 119 (above) was one of the five GE electrics built for the 1200-volt change-over in 1911. At the time this photo was taken (1951), No. 119 was 40 years old.



Dwarfing a passing bus, a PE car negotiates dual-gauge trackage (Los Angeles Transit was narrow gauge) in Los Angeles in 1951.

The great Pacific Electric

Pacific Electric was America's largest interurban system

Richard Steinheimer

Quaint cameo: Los Angeles-bound Pacific Electric PCC car 5009 rolls above Fletcher Drive in 1955. The bridge was the highest on the Glendale line.

BY WILLIAM D. MIDDLETON

THE "world's greatest interurban railway," they called Pacific Electric Railway, and there just wasn't any disputing the proud title. For the tremendous system, which radiated in every direction from Los Angeles, operated over 1000 miles of electric railroad, embracing a huge four-county area and reaching over 125 cities and communities.

This Southern Pacific-owned Southern California traction empire had more than just size to justify its title of "greatest." It had an almost endless variety of lines, services, and equipment. On Pacific Electric you could speed for miles along Pacific beaches, almost within reach of the pounding surf. You could ride through snow-covered mountain scenery in little narrow-gauge open cars. Or you could travel through rural orange groves, vineyards and fields. Pacific Electric had a subway and an elevated; it had four-track, high-speed interurban lines and single track "country trolley" routes; it had smalltown local lines and incredibly busy street car lines where multiple-unit trains were the rule.

Pacific Electric operated almost every possible type of local, suburban, and interurban passenger service, and it had private cars, de luxe parlor car trains, boat trains, excursions with guide-lecturers, and race-track specials. Its passenger rolling stock ranged from single-truck Birney cars to some of the largest steel interurbans ever built.

PE moved a huge freight traffic behind steam and diesel — as well as electric — motive power, and it had a tremendous box motor express and mail business.

Pacific Electric traced its origin to an 1873 horse-car line. Its first interurban line, and one of the first in the nation, was created in 1891 when two local lines were connected by a bridge across the Arroyo Seco and interurban service was provided between Pasadena and Los Angeles. Pacific Electric itself came into being in 1901 when Henry E. Huntington, wealthy nephew of Southern Pacific's Collis P. Huntington, acquired the Los Angeles-Pasadena interurban and began construction of many of the lines that were to make up his great interurban empire. In 1911 PE was merged under SP ownership with three other major companies: the Los Angeles Pacific, the Los Angeles & Redondo, and the Los Angeles Interurban. By 1915, when the huge system was complete, it represented the construction and consolidation of

some 72 separate traction companies.

Southern California electric line construction was tied in closely with real estate activities, and the completion of a new line usually set off a real estate boom. Typical of the promotions that followed the building of an interurban line was the "Grand Opening of Hollywood" staged in 1905 to promote the sale of land in the new development. Special free trains carried passengers to the event, a free barbecue was served, a brass band played, and many lots were sold to future PE riders.

The layout of the PE

During most of its existence as a passenger interurban, PE was divided into three major, semi-independent districts. Largest of them was the Northern District, which included some 400 miles of track and 33 lines, operating north and east from Los Angeles.

An impressive part of the north was the four-track right of way that carried trains to Pasadena and other San Gabriel Valley points. PE's longest and fastest line, the 58-mile San Bernardino line, was part of the Northern District. While the remainder of PE was operated with 600-volt current, the premier San Bernardino line was 1200 volts.

The Western District, made up largely of the lines of PE's predecessor, Los Angeles Pacific, served a vast area to the west of downtown Los Angeles. Among its many destinations were Hollywood, Beverly Hills, Glendale, Burbank, the San Fernando Valley, and the beaches at Santa Monica and Venice.

The west was the site of PE's subway, a mile-long tube completed in 1925, that gave trains a fast exit from the Hill Street Subway Terminal in downtown Los Angeles, but then left them to battle miles of traffic-congested streets. Los Angeles Pacific once had far more ambitious plans for a four-track subway and private right-of-way route from Vineyard to downtown Los Angeles which would have created the greatest rapid transit system west of Chicago. But LAP's plans were "temporarily postponed" during the panic of 1907, and the subway was never built.

The Southern District reached south from Los Angeles to Long Beach and San Pedro in the harbor area, southeast along Pacific beaches to Newport and Balboa and through the orange groves to Santa Ana, and southwest to El Segundo and Redondo Beach.

PE's most fascinating piece of right of way was the spectacular four-track line south from Los Angeles to Watts on the Southern District. Trains of heavy interurban cars raced down the center tracks, overtaking the multiple-unit local cars that kept to the outer tracks. Box motors carrying mail and express, and long freights moving behind M.U.'ed freight motors, shared the busy rails with the passenger cars. During rush hours the parade of trains seemed almost endless and the air was never quiet from the blasting of PE's distinctive air whistles at the many crossings.

Pacific Electric's elevated was even shorter than its subway. Only two blocks long, it carried trains into PE's Sixth and Main Street Station from the Northern and Southern districts. The nine-story terminal building was headquarters for PE and the Los Angeles offices of its owner, Southern Pacific. In addition to the elevated platforms for interurban trains, the building housed a ground floor terminal for trains that arrived over Main Street trackage, and a terminal for PE's extensive box motor express and mail service.

The road once had great ideas for its elevated, too. During the 1920's plans were ready for an extension of elevated trackage that would have carried Northern and Southern district trains from the Sixth and Main terminal across the Los Angeles River to connect with existing private right of way. But depression, and

William K. Barham

Owl-eyed No. 400 (an ex-Southern Pacific car) departing Main Street station reflected PE's 1947 modernization program. Seventy-one "blimp" cars were overhauled, given new plush seats, fitted with safety glass, and repainted in a new scheme.

William D. Middleton

PE's largest class of cars was the center-door "Hollywood" cars which operated on almost all suburban and local lines.

Arthur R. Alter

Pacific Electric RPO 1407 was rebuilt from a Portland, Eugene & Eastern passenger car in 1937. PE had the honor of being the last interurban to have Railway Post Office service.

Steeplecab 1603, a Baldwin-Westinghouse product of 1912, works a long freight train on PE's Santa Monica Air Line in 1941. PE freights were operated by electric, steam, and diesel power.

public sentiment against elevateds, killed these and many other PE improvement plans.

Pacific Electric survived longer than most of the great traction empires. The system's major rail lines were intact at the beginning of World War II, and carried the greatest traffic in PE history — a peak of nearly 110 million rail passengers in 1945. Ancient wood cars, already being scrapped, were pressed back into service, and 80 big interurbans were obtained from abandoned SP traction lines in the San Francisco Bay area to help handle the record crowds.

But bus substitution came swiftly in the years following the war. The fate of the dwindling PE electric passenger operation was sealed in 1953, when the company sold its passenger business to bus operator Jesse L. Haugh's Metropolitan Coach Lines, which immediately announced a goal of all-bus service.

Famous for excursions

Pacific Electric operated all manner of excursions. One of Southern California's greatest tourist attractions was PE's famed Mount Lowe line, originally built in 1893 by Professor Thaddeus S. C. Lowe, for whom the line was named. Standard-gauge trolleys carried excursionists up Rubio Canyon to a pavilion, where there was a hotel, dance hall, and refreshment stand. Above Rubio, the Great Cable Incline carried them to the summit of Echo Mountain, where two additional hotels, the Chalet and Echo Mountain House, were surrounded by such attractions as hiking trails and bridle paths, a zoo, a museum, and an observatory equipped with a 16-inch telescope. The 3-million-candlepower Great World's Fair searchlight, which Professor Lowe bought and installed on Echo Mountain in 1894, was visible 150 miles at sea.

Above Echo Mountain, the 4 miles of 3'-6"-gauge track of the Alpine Division carried the excursionists through spectacular mountain scenery to Mount Lowe Springs, where a fourth hotel, the Alpine Tavern, was built 1100 feet below the summit of the mountain. The narrow-gauge line wound through 127 curves and crossed 18 trestles, and its grades exceeded 7 per cent at points. The roadbed was carved out of solid granite throughout its length. An outstanding feature of the Alpine Division was the Great Circular Bridge, which described an almost complete circle as it carried the cars around a small peak, high above a canyon.

Although the Mount Lowe line operated for over 40 years, billed as the "Greatest Mountain Trolley Trip in the World," troubles plagued it from the start. Fire destroyed Echo Mountain House in 1900, and a 1905 windstorm toppled the Chalet and set a fire which destroyed every building on Echo Mountain but the observatory. A landslide smashed Rubio Hotel to the canyon floor in 1909. In 1936 fire wiped out the last hotel, Alpine Tavern, and two years later a cloudburst destroyed much of the railway itself, closing it forever.

PE's predecessor, Los Angeles Pacific, had become known as the "Balloon Route," after the appearance of a map of its trackage. One of the most popular trolley trips in the West was its "Balloon Route Trolley Trip," which PE continued for many years after the 1911 merger. The Balloon Route excursion, a "10-dollar trip for a dollar," took sightseers out Sunset Boulevard to Hollywood for a visit to the studio of world-famous flower painter Paul de Longpre, through the bean fields around a place called Morocco — better known today as Beverly Hills — and to the Soldier's Home at Sawtelle, where group pictures were taken. The excursionists made a stop at the famous Camera Obscura in Santa Monica before proceeding to the Playa del Rey Pavilion for a fish dinner. Before returning to Los Angeles, the tour visited Moonstone Beach, Redondo, and Venice, which then boasted genuine canals and gondolas.

Similar excursions were operated on almost every part of the vast PE system. The "Orange Empire Trolley Trip" carried trolley excursionists on a 150-mile round trip from Los Angeles to Redlands, visiting scenic attractions in the San Bernardino County citrus area. The "Triangle Trolley Trip" offered a tour of the beach cities south of Los Angeles.

Catalina Island vacationers rode the "Catalina Special," which provided boat-train service to the docks at Wilmington, where a connection was made with steamer service to Avalon. The service still was operated during the summer of 1956, the last of the PE's once-numerous special runs.

Special events in Southern California usually meant a tremendous passenger traffic for PE. Every New Year's Day, thousands rode to Pasadena on PE trains to view the Rose Parade. A race meet at the Santa Anita track meant three- and four-car trains operating on as little as 10-minute headway. The Los Angeles County Fair at Pomona was another event that called for frequent special trains.

Thousands of cars and locomotives of endless variety were operated by Pacific Electric in its long history as the greatest of all traction empires.

Hundreds of city cars were required to operate PE's many local lines in Southern California communities. Single and double truck, open and closed, wood and steel cars — the variations were many.

Passenger equipment

The balmy Southern California climate was perfect for open-air trolley riding most of the year. Most of PE's local, suburban, and interurban cars in the earlier years were of the "California" type, with a closed center section and open at each end, or semi-open cars, with one end open and the other closed. Many of PE's earlier cars came from predecessor companies and included all manner of designs. Some were former steam road cars, rebuilt for electric operation, while others were once narrow-gauge cars.

The largest of PE's car classes, and some of the finest suburban cars ever

William K. Barham

Limited-stop express trains kept to the center tracks and locals to the outer on PE's famous four-track speedway between Los Angeles and Watts on the Southern District.

built, were the 160 steel cars of the 600-759 series, known as "Hollywood" cars. Built in the 1920's, they saw service on almost every PE city and suburban line, and even operated for a time on some interurban routes.

PE's most modern cars were 30 PCC-type suburban cars, which served the Glendale-Burbank line throughout most of their 16-year career. Buses took over the line in 1955.

Many of PE's steel interurbans were boomers, having come from other Southern Pacific traction properties on the West Coast. Some came from SP electric lines at Portland. The most recent arrivals were the 300 and 400 classes, which came early in World War II from Northwestern Pacific's third-rail lines north of the Golden Gate, and SP's Interurban Electric at Oakland. Over 72 feet in length, and weighing up to 63 tons, they were among the largest and heaviest interurbans ever built.

Many de luxe cars graced PE rails. There were observation cars for the numerous trolley excursions, and parlor cars for boat-train service to San Pedro. There were luxurious officers' cars which transported many celebrities, including several presidents, as well as PE brass. Several of them served for years on the de luxe Newport-Balboa *Commodore*. Grandest of them all was the mighty *Alabama*, Henry E. Huntington's private car. Regarded as one of the fastest and finest interurbans ever built, the huge 63-foot 52-ton car, the personal property of Huntington, was kept at his San Marino estate. In later years the ornate car became a parlor-buffet trailer on the Sacramento Northern and its motors and controls were installed on a PE freight locomotive.

Fred H. Matthews Jr.

Pacific Electric's 1000-series cars perhaps were the most well known on the system. Three of them stand at Ocean Park in 1949 prior to a run to Los Angeles via the Venice short line. PE designed the 1000's in 1912; they were delivered by Jewett Car Company in 1913.

Freight service

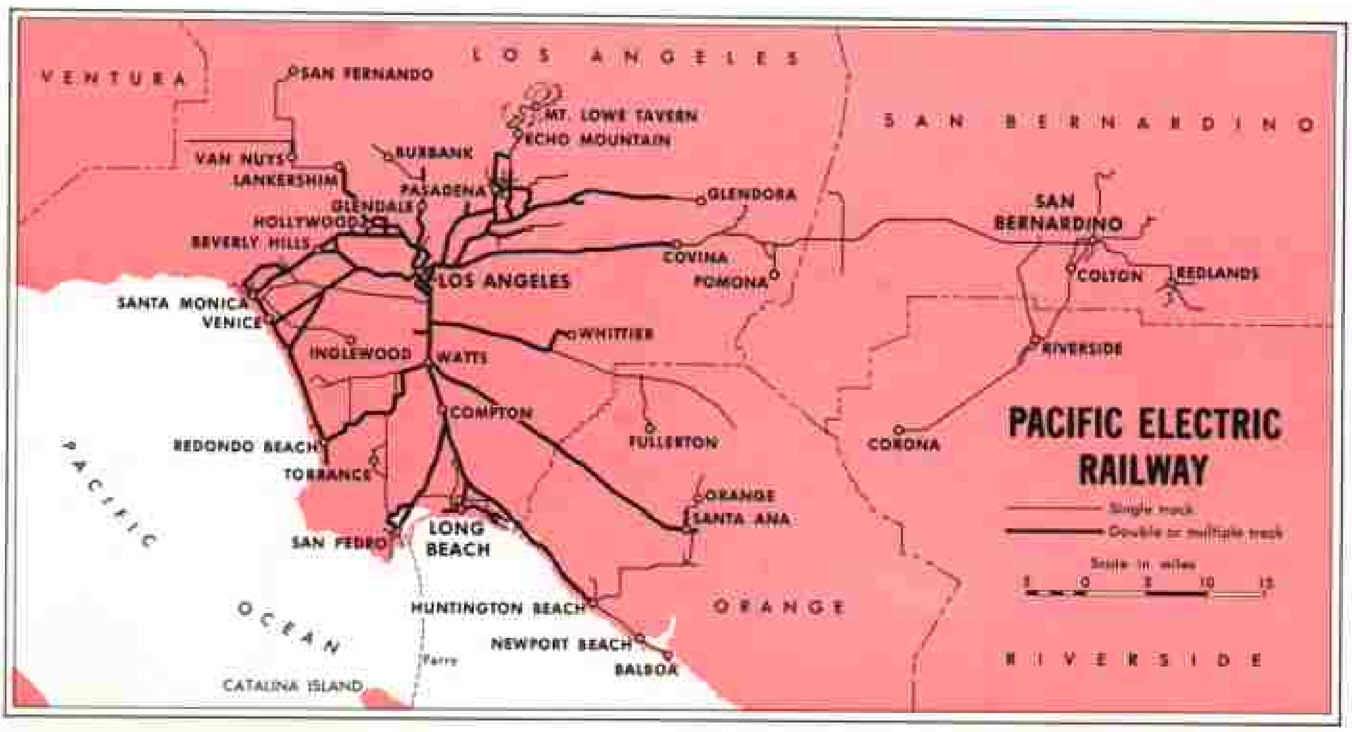
A wide variety of box motor cars, many of them former passenger cars, were operated in PE's extensive mail and express service. Until 1951, PE operated the last interurban Railway Post Office service in the U.S., on the San Bernardino line. Trucks took over PE's box motor service in 1952.

The backbone of PE's freight motive power was a fleet of heavy steeplecab locomotives, almost all of them Baldwin-built or a homemade copy. There was a wide range of lighter electric freight motors as well, and PE had several gas-electrics for operation on isolated sections of track. In earlier days, there were even a few steam locomotives on the PE roster.

During World War II, when freight traffic reached unprecedented levels, hard-pressed PE leased SP steam power for service on the San Bernardino line. Steam power always was double-headed with an electric loco in order to actuate trolley-operated signals. Triple headers sometimes were operated, and there were occasions reported when steam, diesel, and electric power all teamed up on the same train.

Work and service cars are a necessity on any electric line, and PE had them in profuse quantities: tower cars, wire greasers, crane cars, dump cars, rail grinders, portable substations, wreckers, weed burners, even a portable vacuum-cleaner car.

No one could model Pacific Electric in its entirety, of course, but for the model traction builder looking for a prototype for just about anything, Pacific Electric fills the bill. For this was truly an interurban that had almost everything ever seen in the traction world.



All photos by the author.

Newton is the focal point of the Bemis Street Railway. Except for the bulldozer, the highway equipment is partsbuilt and scratchbuilt.

MODEL ELECTRIC LINES

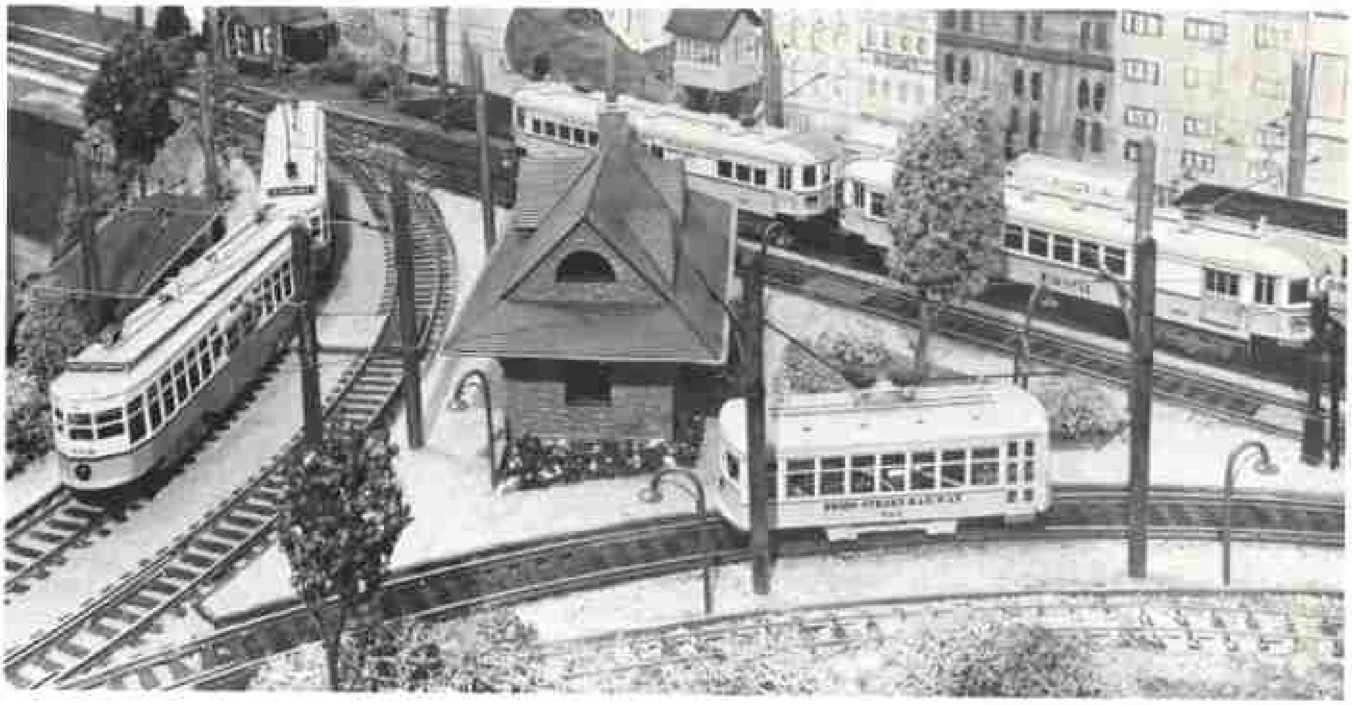
Bemis Street Railway

HO scale traction line operates with full-size controls

BY DAVID L. WADDINGTON

THE Bemis Street Railway of Newton Highlands, Mass. has its mythical operating headquarters in Newton Centre, an imaginary location near Boston. Bemis, however, is an actual geographical area located where the boundaries of the towns of Newton, Waltham, and Watertown adjoin. It takes its name from a tribe of Indians who settled there in precolonial days.

Brass hat and general manager Norton D. Clark has lived all his life in the Newtons — which include Newton Highlands, Newton Centre, Newton Corner, Newton Upper Falls and Newton Lower Falls — so it is only natural that he is intimately familiar with local history. He has a strong affection for both the railroad and the street railway companies that flourished there. Although the Bemis Street Railway rolling stock is patterned after various equipment from all over the country as dictated by commercially available items, its pattern of passenger service is strongly influenced by the prototype ramblings and machinations of the prototype Middlesex & Boston Street Railway. This line is fondly remembered by local trolley enthusiasts although it has long since been converted to buses. Express package traffic on the Bemis line, handled with box motors and trailers, is reminiscent of the through services once operated by the Boston & Worcester Trolley Air Line and the Worcester & Springfield Street Railway. Interchange carload movements are inspired principally by the Grafton & Upton Railroad and the Linwood Street Railway, two of the several New England properties where diminutive steeplecab electric locomotives once hauled railroad freight



Electric Junction is an active spot on the system. The two center-entrance cars on the double-track curve are a Boston Elevated train. To accommodate baseball specials, Boston Elevated has trackage rights over the Bemis Street Railway from Newton to Bemis. The BE cars are Model Tramway imports; the ex-North Shore Line cars (Suydam) in the rear are used for rush-hour service and extra trips beyond the capacity of one-man equipment. The Birney car on the third leg of the wye handles the Norumbega Park shuttle. Narrow-gauge trackage belongs to Whittin Machine Works.

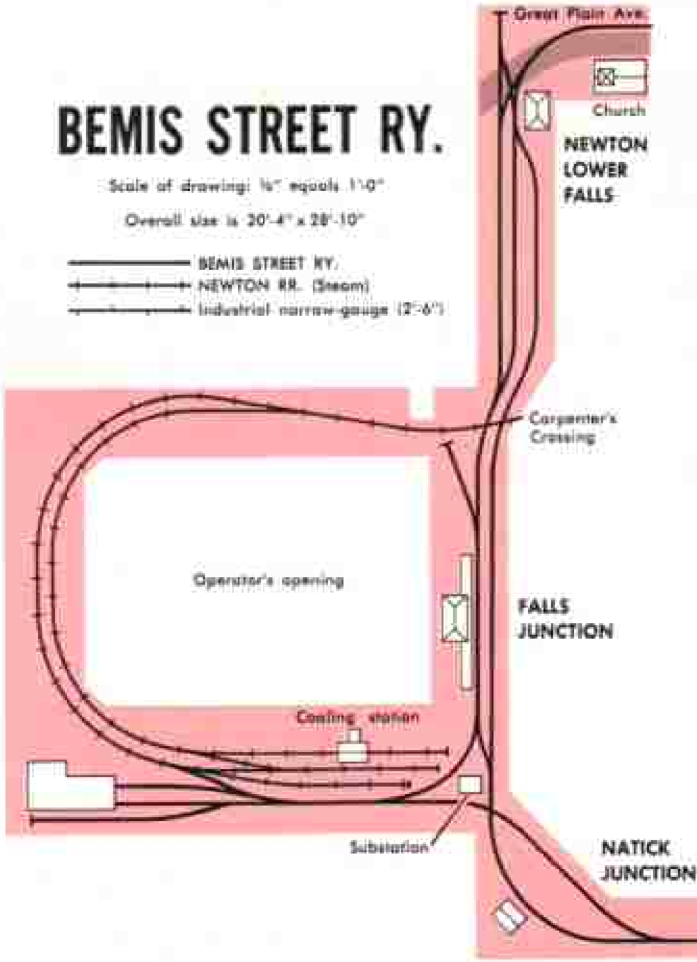
cars along the grassy side of the road, or through rights of way in the woods.

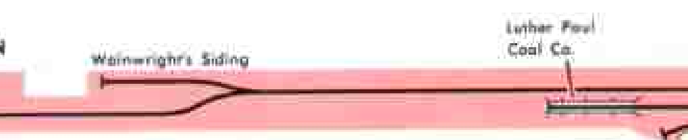
The Bemis Street Railway had its HO beginning in equipment built from kits presented to Clark in 1940 by an uncle. This effort replaced an earlier extensive O gauge tinplate layout which featured equipment of all three of the major tinplate makers. The permanent HO layout started to take place when Clark acquired his present house in 1962. Now it sprawls through the major part of the 21 x 29-foot basement.

Operation on the Bemis Street Railway is a testimonial to the potentialities of HO traction. Dewirements are infrequent and derailments are rare indeed — this on a layout that abounds in sharp curves and complex trackwork. Track construction is one of the management's special interests. All of the crossings and turnouts were built from code 100 rail. Turnouts include several three-way turnouts and a large number of single-tongue-and-mate turnouts. The overhead-trolley power distribution eliminates the rail-gap problems that would be a headache in equally complicated two-rail trackage.

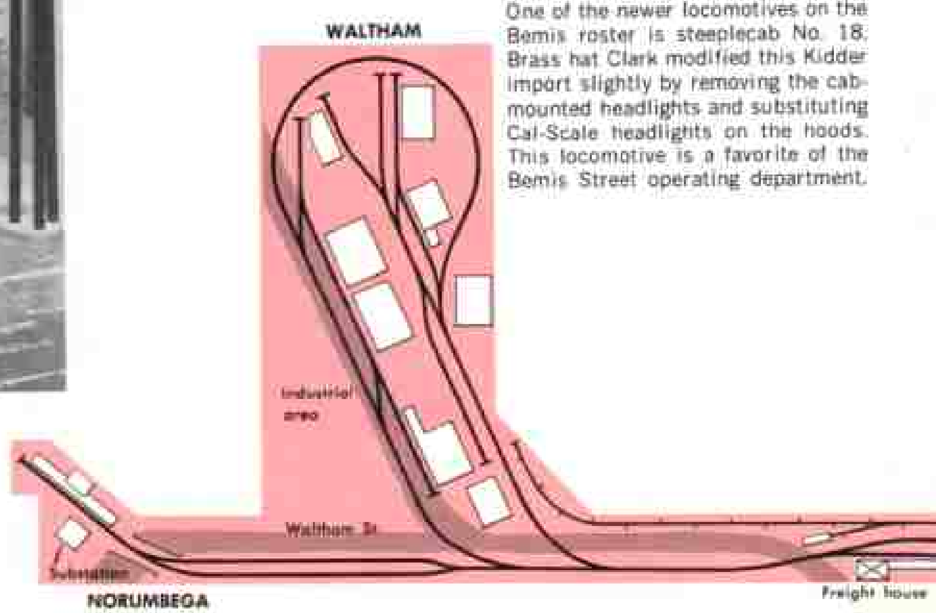
The line has operated for the major part of its life without benefit of scenery. Some gentle needling in 1967 from visit-

A two-car freight extra is waiting for passenger-car 623 to clear the crossing at Newton station. Freight motor 641, seen head on, is a Ken Kidder import of a Cincinnati & Lake Erie prototype. Car 303 trailing it was built in the Bemis Street Railway shops from a La Belle kit. In the service equipment garage in the rear are a 1924 White line truck and a 1927 White emergency wreck truck, both scratchbuilt. The trolley plow beside the garage also is scratchbuilt. Norton D. (Skip) Clark, owner of BSR, handmade the crossings and turnouts.





One of the newer locomotives on the Bemis roster is steeplecab No. 18. Brass hat Clark modified this Kidder import slightly by removing the cab-mounted headlights and substituting Cal-Scale headlights on the hoods. This locomotive is a favorite of the Bemis Street operating department.



The Bemis Street Railway is operated with full-size controls. This controller came from Grafton & Upton GE steeplecab No. 8. The airbrake stand and gauge are from Massachusetts Bay Transit Authority (formerly Boston Elevated) equipment; the circuit breaker is from car 415 of the Union Street Railway of New Bedford, Mass.

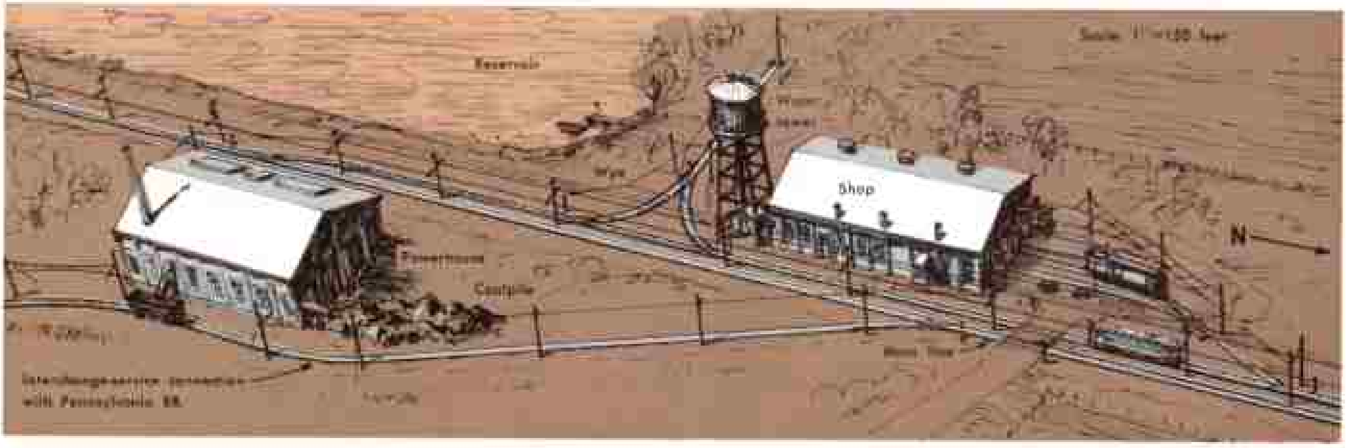
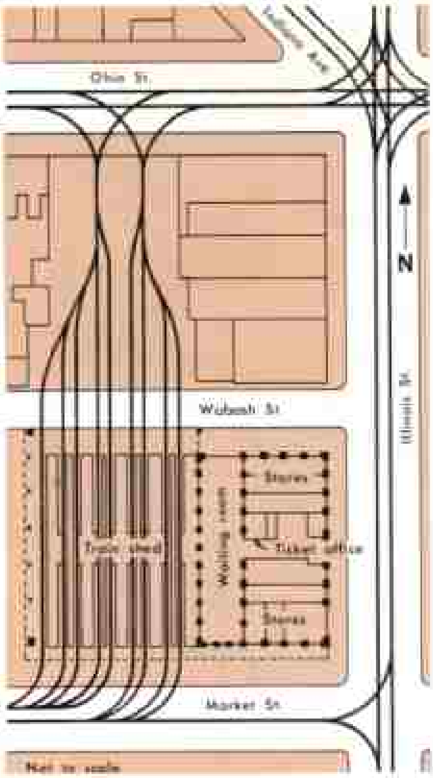
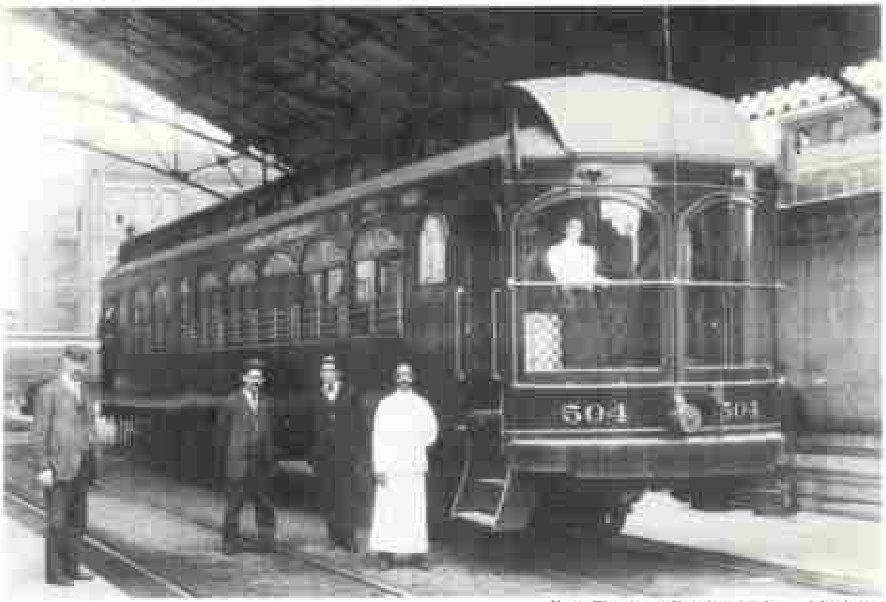


Fig. 6. The line between Indianapolis, Ind., and Louisville, Ky., on the Interstate Public Service Company (later Indiana Railroad) was located adjacent to the main shops at Scottsburg, Ind. An interchange with the Pennsylvania Railroad served not only for general freight but also for coal delivery to the powerhouse. The shop was 70 x 173 feet, and the powerhouse measured 96 x 107 feet.

Bass Photo, collection of Jerry Marlette

Fig. 8. This short spur siding on the Terre Haute, Indianapolis & Eastern at Ogden, near Dunreith, Ind., was protected by a crude semaphore that was rodded to the switchpoints. Notice the double wire serving the main line, and the third wire serving the siding.





Bass Photo, collection of Jerry Marlette.

Fig. 2. The Fort Wayne & Wabash Valley Traction Company operated an elegant parlor-observation car, No. 504, posed here at Indianapolis Traction Terminal in 1906.

Fig. 3. The Indianapolis Traction Terminal, a station and eight stores surmounted by an office building, was located at the junction of Market and Illinois streets. A minor street (Wabash) and a walk for passengers cut across all nine of the station's tracks.

nals in the larger cities. Probably the most common practice was to use a store located on or near the town square, remodeling it into a station by installing a ticket counter, newsstand, benches, and rest rooms. However, there were numerous instances of well-built frame, brick, or stone structures. Many of these were combined either with substations or with agents' living quarters.

Station trackage was usually simple. Where a store was rented for the waiting room and ticket office, the interurban merely stopped in the middle of the street opposite it, holding up all rail — and most of the street — traffic while loading. This practice still occurs on the South Shore Line at Michigan City, Ind., on the last remnant of the interurban in that area, and one of the last in the country.

Sometimes the track would turn off the street and stop beside a building in a private alleyway. A grander development of this was very common in larger cities, where the platforms were located under shelter. This was the situation in Fort Wayne, Terre Haute, Muncie, and Indianapolis. Examples in other parts of the country were in Los Angeles; Milwaukee; Denver; Akron; Dallas; Vancouver, B.C.; and many other places. Sometimes the shelter was merely an extension of the building's eaves, while sometimes the building was partly built above the track.

The outstanding example of an interurban station in Indiana, and a contender for championship anywhere, was the nine-track terminal in Indianapolis, shown in figs. 1, 2, and 3. The tracks were paired under a huge arched roof. At the side, the station quarters were on the first floor of a company-owned nine-story office building. Nearby were three freight sheds with additional tracks. All the lines into the city used this downtown terminal even before they were merged into one system. In the opening year, 1904, some 5 million passengers patronized it.

In this terminal, and commonly elsewhere, train movement was one way on any particular track. The cars entered via specialwork (electric railway terminology for a complex group of turnouts) from one street and left via another street. At Indianapolis at the height of operation, tracks 1 through 4 were operated northward for trains to and from the east and north, while tracks 5 through 9 were operated southbound for trains to other directions. This was partly dictated by the arrangement of the city car tracks which the interurbans used to reach the outskirts.

Upon entering the terminal, a train would proceed to a spot for unloading. The location assigned depended on the traffic volume and the time until the train's departure. The train could then either remain in that spot or be moved

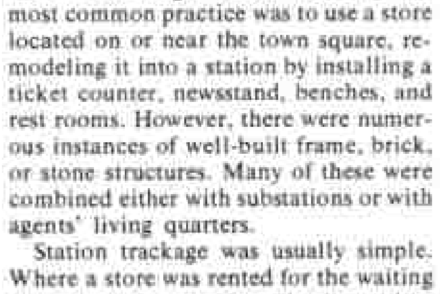


Fig. 4. Interurban station design for moderate-size towns varied. This basic plan included a substation and a transformer room. Doors were wide enough to allow electrical equipment to be delivered.

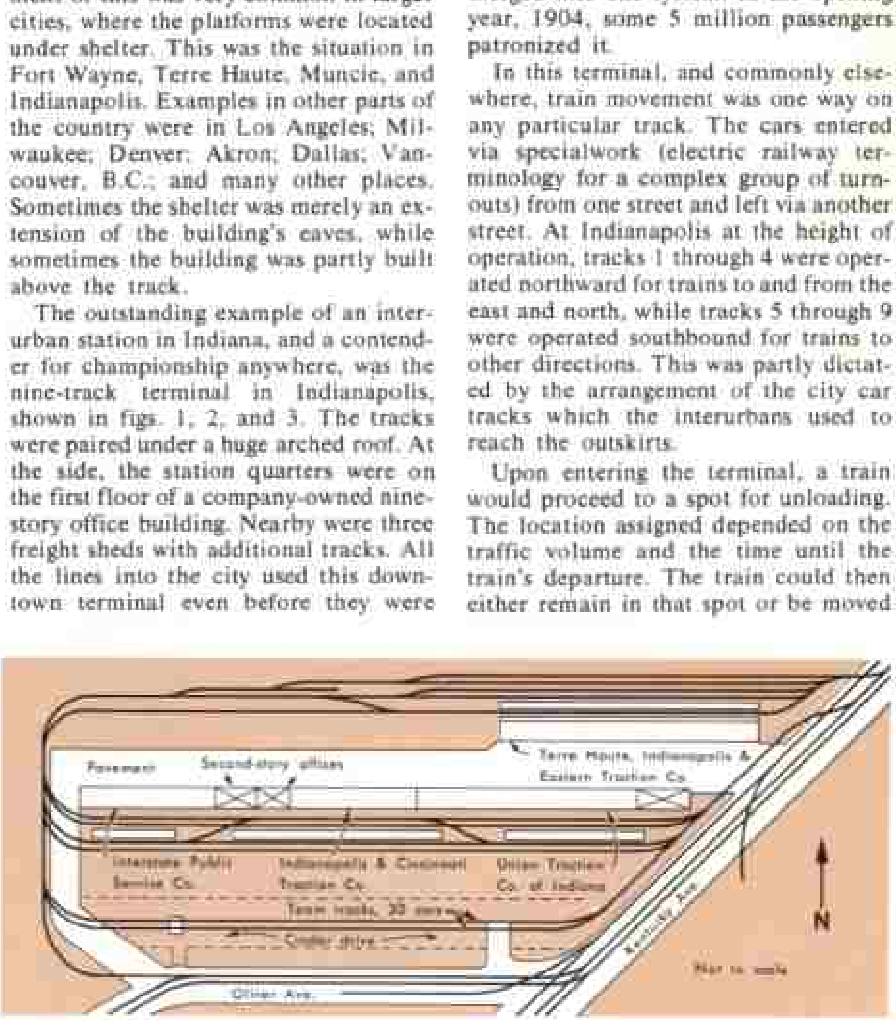


Fig. 5. Indianapolis traction freight business grew so big that this large terminal, more than 1000 feet long, was built in the 1920's. It had a track capacity of 100 cars.

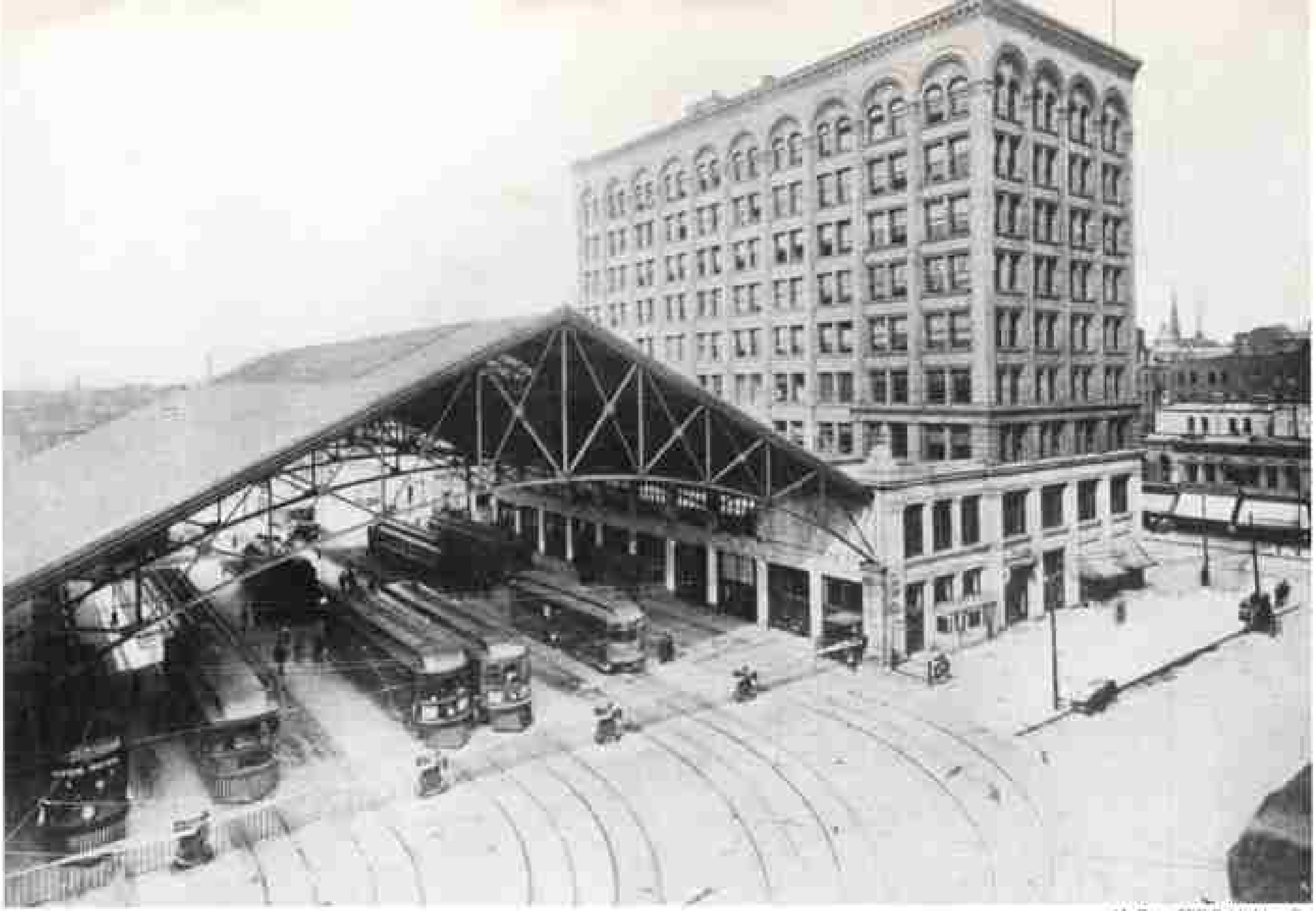


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Fig. 1. Automatic gates discouraged passengers from walking direct to trains from sidewalks at the busy Indianapolis Traction Terminal.

TRACTION AND MODELING

Interurban right of way

. . . with the great systems of Indiana as a focal point

BY JERRY MARLETTE

THE growing popularity of interurban modeling may in part be attributed to the disappearance of nearly all of the prototype lines, in the same way that the steam locomotive has become such a matter of interest since its virtual extinction as a prime mover. Sentiment aside, however, the model interurban layout has many practical features in its favor. Possibly the most important is that a complete layout can be built in a fraction of the space required for a similarly complete steam or diesel road. Short trains, small-radius curves, and less complex yards and stations are great advantages.

I think, too, the model interurban is more realistic in appearance. A four- or five-car freight train is exact prototype on an interurban line, while a complete freight train on a steam or diesel road would require several times that many cars. When overhead wire is used, power distribution is 100 per cent realistic. Finally, the model interurban system has the advantage of being comparatively inexpensive. Power cars cost only one fourth to one half what a comparable unit of steam or diesel power costs. There can be savings in track, structures, and other items in proportion. Of course, the overhead is an extra cost.

It might be good to review the characteristics of the interurban railroad. In many ways the interurban closely resembled the steam road, while in other ways there were marked differences. Among the resemblances were well-built roadbeds; steel girder and truss bridges; block signaling and train order dispatching; and a wide range of passenger car types, including parlor, dining, sleeping cars, and even observation-lounge cars.

The interurban differed from the steam road in the frequent, almost universal, use of city streets for entering cities and towns; short sidings of as little as two- or three-car capacity; frequent operation of one-car and other short trains; limited types of freight cars — generally only box, flat, stock, and dump cars. In addition, interurbans rarely used rail heavier than 70-pound.

My experience, and thus the basis for this story, is mainly on prototype construction of the now-abandoned Indiana interurban lines. Most other regions had lines that were basically similar, especially in the Midwest.

Stations

Interurban stations varied in size from drawer space and a bench in a number of small towns to large multitracked termi-

The Bayside electric line meanders over, under, and around the layout.

(Above right) Milwaukee Northern 1100 swings off street trackage and onto private right of way leaving Bayside. The car is typical of the equipment on the electric line, which is patterned after Milwaukee-area traction lines.

The carbarn at Wiscona Junction is the main terminal for the traction line, which services a half-dozen industries here with a steeplecab motor.

An interurban on the Bayside line holds clear of the crossing as a Pennsylvania mineral train rumbles along the freight-yard bypass.

There is little activity in the downtown traction terminal's train-shed as the evening steam-railroad local swings around the curve.

low modelers from the Sterling/Dixon, Ill., area. The concept of the LP&T is that of a metropolitan terminal railroad with large freight and passenger yards served by a variety of railroads. The LP&T represents an era of steam and early-diesel railroading, but an interesting feature of the layout is the overhead-powered trolley system, added *after* the steam road was completed. The traction line tunnels under, bridges over, and squeezes around previously installed trackwork — a truly meandering interurban. There are two lines on the trolley system, both of which are operated out of a downtown terminal. The Bayside line is the shorter but more rugged route; this runs past the LP&T's main freight yard to the waterfront area. It has street running, beside-the-road running, and private right of way. This line sees heavy interurban equipment, city cars, and trolley freight trains. The Wiscona line runs in the street for a short distance, then joins the steam road. Its overhead extends across the back of the layout to Wiscona Junction, where the interurban turns off into its own yard and carbarn. Most freight traffic on the trolley system is routed over this line, although interurban cars also use it. The fact that the traction line interchanges with the steam road makes it an integral part of the whole LP&T system.

LP&T's traction system certainly adds flavor to this late-1940's-era railroad and is truly an example of a successful addition of a trolley line to a model railroad layout.

All photos, Jim Boyd.

Lake Port & Terminal's traction line was added after the steam road was completed. This overall view of Bayside shows LP&T's freight yards and engine terminal, and the interurban line that terminates in Bayside. The electric line parallels the highway into town, then swings onto the pavement before crossing the Pennsylvania Railroad main line. After trundling through the streets of Bayside, the cars loop to change direction. Passenger awaiting car at triangular trolley depot seems to have fainted.

Traction line addition

Double the operating variety of your present model railroad — a trolley line will fit in with minimum extra space

BY LINN WESTCOTT

PERHAPS you are a modeler who is fascinated by overhead wirework and roving trolley cars, but would prefer to keep your model railroad primarily steam- or diesel-operated. Consider adding a streetcar or an interurban line to the layout. A traction addition can be simple or complex, but it will add a great deal of variety to operation.

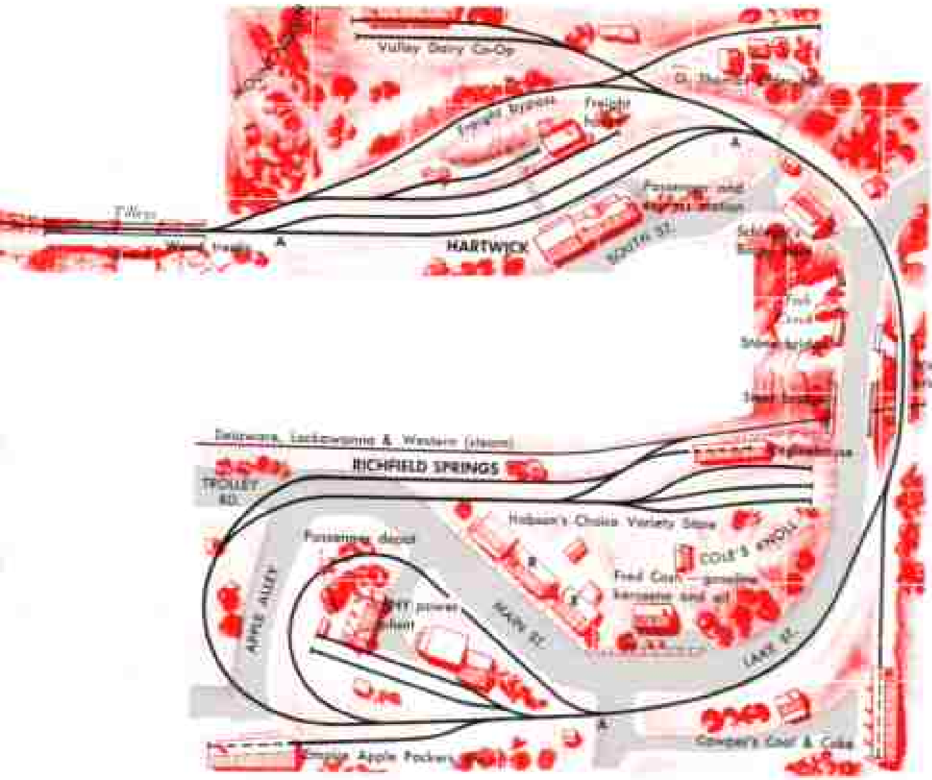
How about a streetcar line? If you don't have much space or your funds are limited, perhaps a one-lap line around a city block would be suitable. As time and money permit, expand it to include several city blocks; add a switch for a branch that extends to the beach, amusement park, cemetery, or the city limits. Run a line to the main railroad depot in town so that passengers detraining from steam limiteds and streamliners will have a means of getting to their final destination.

An interurban line could be even more interesting. What is nice about a model interurban system added to an existing layout is that it requires little additional space. Your interurban line could closely parallel the steam road's route or run along the shoulder of a highway, much like the prototype did years ago. Interurban right of way is synonymous with sharp curves, steep grades, and track laid "over hill and dale" with minimal grading — another reason an electric line could be fitted into almost any existing layout.

When entering a city, lay the interurban mainline tracks right down the middle of Main Street; or if the city has a streetcar line, "negotiate" with the streetcar company for trackage rights into the city. Many prototype lines did this.

BY JIM BOYD

Let's visit the Lake Port & Terminal Railway, built by Don Goshert and fel-



This view of steeplecab No. 95, a product of Southern New York Railway's improvement program, was photographed by a railfan who climbed onto the roof of the transfer company's freight shed. No. 95 is pushing a car of materials onto the Leatherstocking Hosiery Company spur in Oneonta. Trainmen refer to this as the "silk stocking run."

tion. New streets were laid. Industrial spurs leading from the new freight belt line were constructed by the SNY. The railway's express depot was moved to a more central location which permitted additional offstreet loading space for express trailers. A transfer company acquired its own terminal, and a major industry was provided with convenient inplant rail facilities. By providing a rail siding for it, a lumber company was induced to locate on SNY property adjacent to the passenger depot.

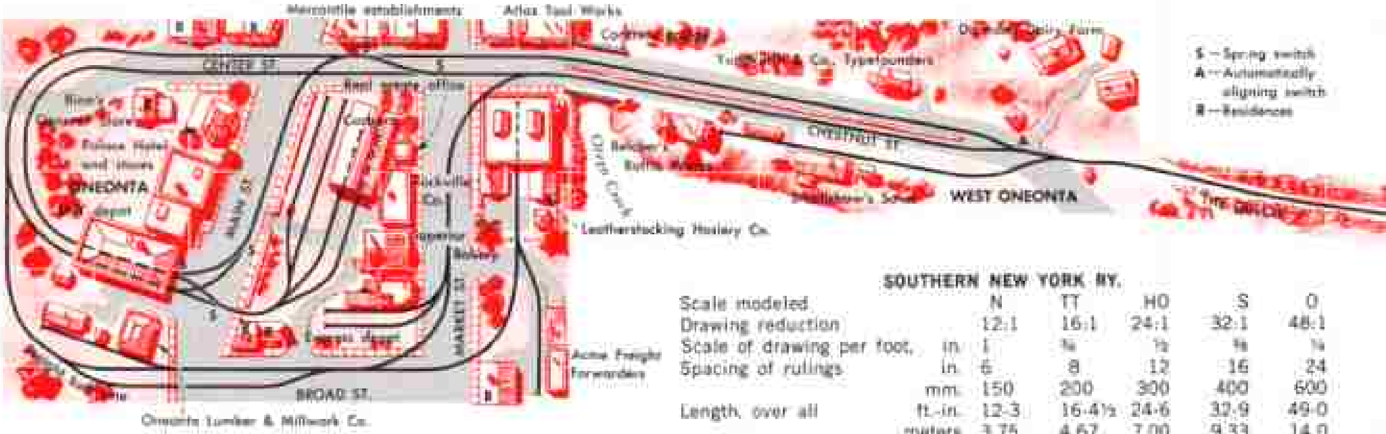
The SNY passenger depot and carbarn trackwork were redesigned for better traffic flow and to provide larger storage and maintenance areas. Main Street again became the focal point of civic activity. It also came to be a center of interest for railfans and rail photographers.

The comprehensive urban-cum-rail renewal program was celebrated by the SNY management in fitting fashion. Invitations were sent to the presidents of all the electric railway lines with which the SNY had interchange and tariff arrangements. The president of the Walkill Valley Traction Co. arrived in one of his own line's cars — the accomplishment which led to that company's arranging regularly scheduled service to and from Walkill Valley points over SNY and WVT tracks.

Walkill Valley Traction's heavy interurban No. 17 passes West Oneonta on a pool-service run to Richfield Springs. The aged box car in the left foreground now serves as a lineside toolshed for the SNY. A railroad lineman is preparing to do some maintenance work from the tower car on Smallshaw siding.

In the first days of operation following completion of the urban renewal program, many difficulties were experienced getting cars over the new trackage. High spots in the paving had to be shaved; flangeways had to be cleaned; track and overhead wire surfaces had to be checked for dirt and alignment. These corrections were tedious but resulted in quite acceptable performance.

"Can't you ever just sit down and run it around and around?" was one visitor's querulous comment to John. Well, cars and freight trains *can* run "around and around," he replied; but normal operation means local and express passenger schedules alternating with freight movements, l.c.l. shipments in box motors and trailers, and less frequent sorties by work equipment — operation is more interesting that way!



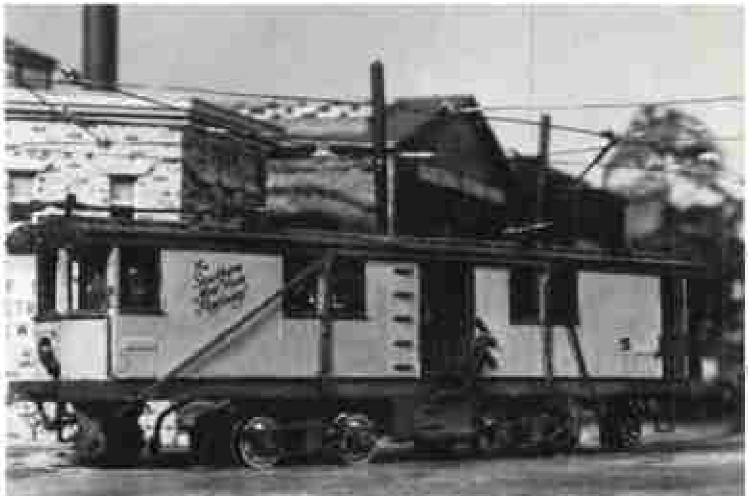
SOUTHERN NEW YORK RY.

		N	TT	HO	S	O
Scale modeled		N	TT	HO	S	O
Drawing reduction		12:1	16:1	24:1	32:1	48:1
Scale of drawing per foot,	in.	1	¾	½	⅜	¼
Spacing of rulings	in.	6	8	12	16	24
	mm.	150	200	300	400	600
Length, over all	ft.-in.	12-3	16-4½	24-6	32-9	49-0
	meters	3.75	4.67	7.00	9.33	14.0
Width, over all	ft.-in.	4-0	5-4	8-0	10-8	16-0
	meters	1.22	1.63	2.44	3.25	4.88
Minimum radius,	in.	5	6.67	10	13.3	20
mainline tracks	mm.	125	170	250	340	500
Turnout size		Custom-fit radius-type turnouts.				

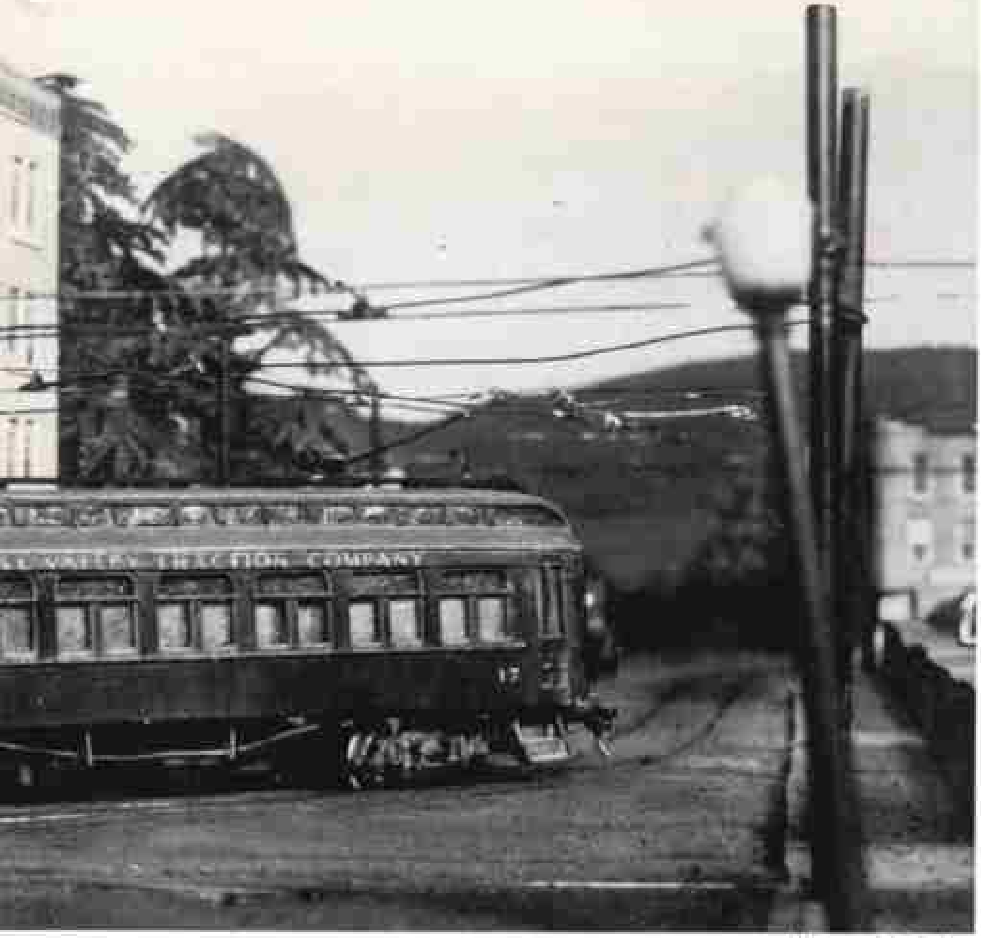
Steeplecab No. 90, purchased from the Albany Southern and rebuilt to Southern New York Railway standards, is about to enter the Broad Street track on the belt line around Oneonta.

SNY motor 123 eases a mixed train of three reefers and a combine over the steel bridge leading to Richfield Springs.

In this panoramic view of Richfield Springs, a steeplecab dozes in the carbarn as the "house on a raft" line car heads to the street. To the right, No. 62 of SNY's interurban fleet, a handsome, arch-windowed car, pauses for passengers.



The snow sweeper is SNY's pride and joy. It posed for the company's official equipment photograph after it had been painted in SNY traction orange and tuscan red shortly after its arrival from the supplier, Huntingdon Model Works. SNY officials are certain that No. 5's solid metal construction and operating snow brushes will be extremely helpful in keeping the tracks clear, and they no longer will have to make excuses for suspended service when the "white and beautiful" piles up.



All photos, John Sheldon

York Railway

Welcome to Oneonta. Walkill Valley Traction's No. 17 (above) pulls into the depot while the motorman of a single-truck car waits for the handsome interurban to clear Main Street. (Below left) Two city cars pass near Main and Center streets. Market Street (below) is Oneonta's commercial street. Here freight and express motors must feel their way past trucks and drays. Express motor 21, with a trailer in tow, heads toward the SNY express depot at Broad and Market streets.

Walkill Valley interurban roaming SNY rails as part of a joint service offered by SNY and the nearby Walkill Valley Traction Co.

Other interesting SNY equipment includes a steeplecab locomotive purchased from the Albany Southern, and a double-truck snow sweeper from the Philadelphia street railway system. The steeplecab was converted to overhead pickup with trolley pole reverse according to SNY requirements and standards. The snow sweeper is from the Huntingdon Model Works, and the SNY operating personnel is considerably impressed with its design and operation. It has excellent detail, and is of solid, welded (well-soldered) construction. The sweeper brushes are separately powered and can operate singly. The headlights operate in the direction of travel. To capitalize on the sweeper's trim lines and unusual appearance, great care was taken in painting it bright traction orange and tuscan red.

SNY painting policy

All newly acquired SNY equipment is painted traction orange and tuscan red, with truck frames and undergear industrial black. Custom-printed SNY heralds of the dry-transfer type are standard on SNY equipment.

As the equipment sees service, the orange darkens in color; and roofs and trim become more of a roof-brown shade. Dust, mud, and rust show increasingly as signs of road duty on the industrial black. The road's veteran cars wear these badges of service with unspoken pride.

Keeping things under control

Control circuitry is simple on the SNY. Rail is gapped to form a number of control blocks. Trolley pole reverse is universally used — except on the snow sweeper; the master mechanic can't figure out how to accomplish it on that unit. The single-pole old city car is another exception.

The power source is a transistorized power pack. It develops realistic acceleration. A simpler transistorized pack is available for auxiliary use when traffic demands. An A-off-B switch for each block is used on the control panel to select from either power source or to deaden the section.

Some of the wood ties are not as high as the others, but instead carry a brass strip on top. These brass crossties help keep the track in gauge and also improve the electical continuity in each block.

Urban renewal

The Southern New York Railway recently took part in an urban renewal project in conjunction with the city of Oneonta. Results of the program were manyfold and gratifying. The city limits were expanded to include new residential, business, and industrial construc-

BY JOHN SHELDON

THE HO scale Southern New York Railway is an electric interurban system constructed by John Sheldon of Yorktown Heights, N.Y. The model SNY's focal point is the city of Oneonta; from there the interurban line traverses the beautiful valleys of central New York state northward to Richfield Springs via the village of Hartwick.

Construction details

Right of way on the SNY utilizes code 70 nickel-silver rail laid on top-grade wood ties. Crossings and both spring- and hand-throw turnouts were scratchbuilt. Overhead is phosphor bronze wire hung from cast hardware. Span wires are supported from brass poles painted black to represent cast iron or weathered wood, as appropriate to the location.

Structures in Oneonta as well as elsewhere in SNY territory derive in architecture and construction from many sources, with the goal of fitting harmoniously in the atmosphere of a New York State interurban serving the towns and agricultural areas in the mid-1920's.

The interurban depot in Oneonta and the station in Hartwick are Suydam designs. The Palace Hotel is from a cardboard apartment house with one side brought forward to form the recessed front section. Binn's old general store has eluded the sweep of urban renewal; it began life as a haunted-house kit from Alexander. Vollmer furnished the basic materials for the lumberyard general office, the plant of the Rockville Co., and the real estate office. These structures were enlarged by kit-bashing. Other buildings are mostly scratchbuilt but make use of cast metal and plastic windows and doors freely. German embossed stone and brick paper and Northeastern wood siding and lumber are frequently used.

Street paving is sheet basswood with edges chamfered to butt against the rail. Wheel grooves are shaped in plastic wood, a handy and workable material that is also used around switchwork and crossings. Sidewalks are of basswood painted several shades lighter than the gray asphalt of the street pavements. One street in the industrial section is paved with brick paper; its tan roadway contrasts nicely with the red brickwork in front of the carbarn.

Streetlamps, both gas and electric, had their bases cut short to reduce them to more compatible and aesthetic heights. The trees — from Britain's of Britain by reverse lend-lease — are particularly enjoyed by Oneonta citizens.

Equipment on the SNY

Southern New York Railway's roster includes two interurban cars, three city cars, and quite a selection of box motors, locomotives, and powered maintenance equipment. One also will find a

The Southern New

John Sheldon's traction layout captures the flavor of the interurban era in southern New York state

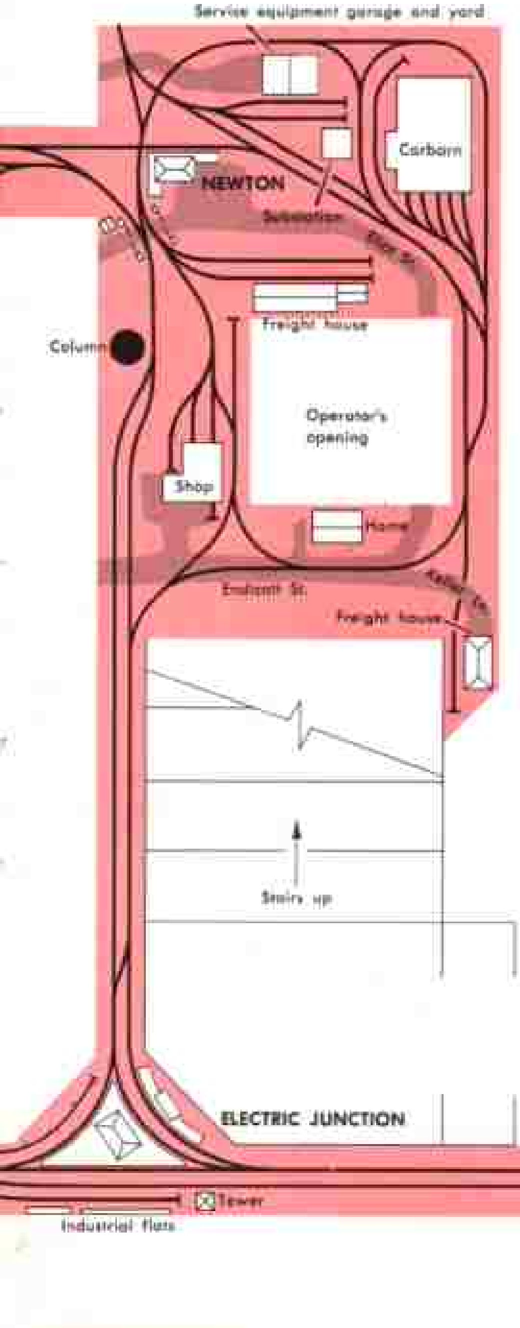
The 40-ton Baldwin-Westinghouse B-1 locomotive (left) is a veteran on the Bemis freight roster. It was modeled after a Springfield (Vt.) Terminal engine of the same number. Car 623 (above) is a Model Tramways import. This car has handled the base interurban passenger service since Bemis converted to one-man operation.

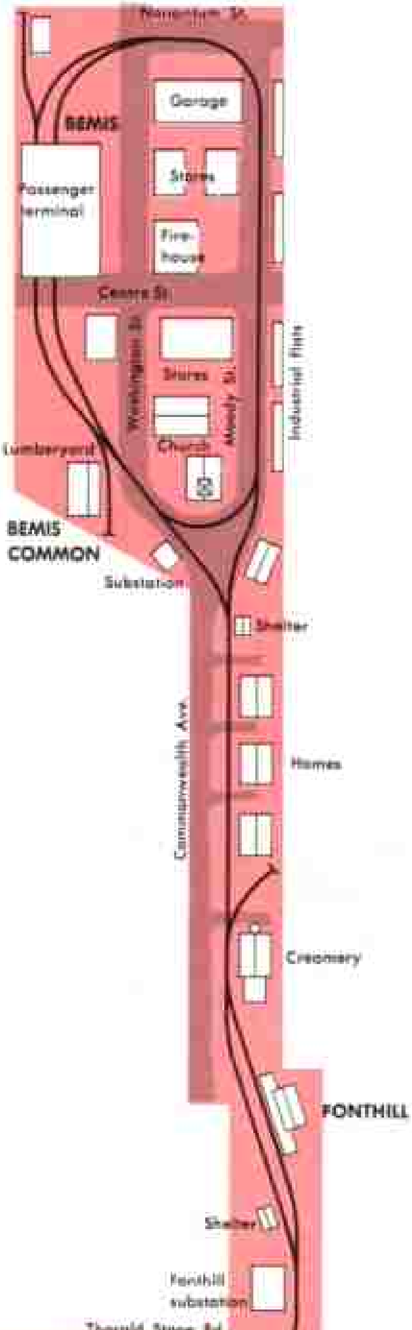
ing traction modeler Dick Orr, of Omaha, Nebr., resulted in a belated start on this phase of the hobby. If the sharp-eyed reader notices that the photos concentrate upon only two or three locations on the line, he will accept the explanation that these are the areas where scenery is farthest advanced.

Operating in conjunction with the trolley line is a modest amount of two-rail trackage under the corporate title of Newton Railroad. Because both lines represent a pre-1969 scene we can still imagine that the Newton Railroad is a bridge line connecting the New Haven Railroad with other New England carriers, including the Bemis Street Railway. As would be dictated by such a prototype situation, the majority of the steam-road cars on the system are from New England carriers. One car is a Clicquot Club refrigerator car which commemorates a local prototype bottling firm which once had some private-owner reefers.

Stations along the line are named for points of prototype trolley interest which Clark has visited — Electric Junction, for example, is a name found on the Niagara, St. Catharines & Toronto Railway.

Standard company colors on the Bemis Street Railway's equipment are kiltie yellow lower sides, aircraft cream window sash and letterboards, dove gray roof, and black and red trim.





off to a storage track to make room for other trains. With 35,000 passengers and 596 trains passing through the station every day (1916), the only trains tarrying for very long in the station were the last ones at night. These waited in position for dawn departures. After loading, the trains proceeded out the other end of the station, around the block, and reversed their inbound course to leave the city.

While the nine-track terminal seems a rather ambitious and overshadowing project for the average model interurban line, many similar but smaller terminals — usually three- or four-track — existed. A shed with four four-car tracks and a three- or four-story station building would be a respectable terminal for any model interurban empire.

Another very popular small station found with minor variations throughout the country is shown in fig. 4. Used as a terminal on small lines, or as a junction or turnaround point on larger ones, the station included a small ticket office and waiting room. A substation and living quarters for the agent might be included; also, if no separate freight building was provided, a small express and l.c.l. freight room might be added. A narrow team area alongside a two- to four-car stub track completed the station layout.

Freight terminals and shops

Freight terminals also varied, ranging from a single short stub track to such large multitrack yards as the one at Indianapolis, fig. 5, built in 1923. It was needed to relieve congestion around the downtown terminal and was located just outside the Indianapolis business district. It featured two main sheds, one 928 feet long, the other 401 feet. The sheds were the last word in freight handling when built, including in their design such items as roll-up doors and weighing scales to speed handling of l.c.l. freight. They tripled the capacity of the former terminal. When all the lines in central Indiana consolidated into the Indiana Railroad System in 1931, sufficient space savings were effected in the terminal to lease the north (smaller) shed to truck lines, while the Indiana Railroad retained the larger one. The new consolidated terminal had a house track capacity of 42 cars, a team track of 55 cars, and dock space for some 50 trucks.

This terminal plan lends itself admirably to reduction of facilities for a model.

One of the most interesting parts of any railroad is the shop area, where anything can be, and usually is, found. On an interurban line especially the shops served as the "gathering spot for the clan," and here at least one of everything the road had ever owned, from four-wheel mule cars to the latest locomotives, generally could be found. In the shops some cars were in just for routine inspection and cleaning, some for repairs, while others were relegated to storage tracks on the back lot, awaiting the scrap dealer.

Very few model interurban layouts have anything resembling complete shops. The reason? It might be lack of plan data, or too complicated a project, or perhaps it is being put off until the road is in full operation. Actually an interurban shop is not as complicated as it might seem. Basically it breaks down into a few simple components that may include repair shop buildings, storage yard, and trackage that usually includes a wye or loop. Complex transfer tables, cranes, pits, and machine shops need not necessarily be modeled. Instead they can be imagined as being inside the shop buildings — and thus forgotten, as far as

Glenn Niceley.

Fig. 7. A simple path along the track provided access to this freight and passenger station at Lagro, Ind. The poweryard by the road contained transformers under the A-shaped frame, and circuit contactors with multiple hoods. Reduced voltage passed on to the substation where a motor-generator converted it to 600 volts. Some installations used 1200 volts.

Bass Photo, collection of Jerry Marlette.

Fig. 9. Curved track was superelevated for operation at speed. Note the cattle guards, span-wire support of overhead wire, and the crude support for the platform and waiting shed. The "birdhouse" on the pole actually may have been a light, operated by a switch on the shed, for hailing trains. Station name, Antioch, was painted on a rectangular panel hanging from span wire at upper right. This Terre Haute, Indianapolis & Eastern line went to Frankfort, Ind. Note that each house in the background had its own windmill.

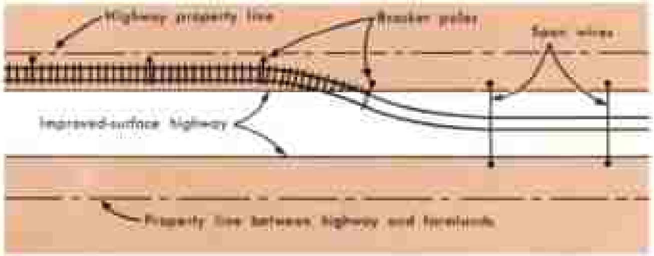


Fig. 10. Roadside interurban lines entered villages by curving onto the road; they swung back on the opposite side of town.

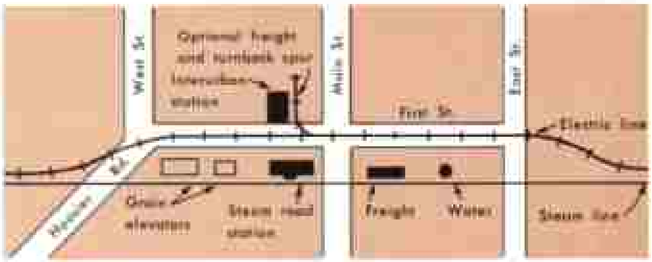


Fig. 11. Lines paralleling steam roads usually swung onto the nearest street to go through a village, thus avoiding steam properties.

modeling such facilities is concerned.

A medium-size shop fairly representative of the 1920's was at Scottsburg on the Indiana Public Service system. See fig. 6. Note the reservoir for boiler water. Also, coal had to be stored beside any power plant, except for the few that used water power.

Power plants and substations

Many interurban lines had their own power plants, not necessarily beside the shops. Some, of course, were parts of large electric utility systems, so the size varied greatly.

Currents to run electric trains were so high that voltage loss along the feeder lines was serious. Some very old car lines suffered severe loss of speed — sometimes even stalled — when operating far from the power plant. To overcome this, the substation was invented. This acted somewhat like a transformer but in most cases had to produce direct current, so some sort of rotary equipment was used. At first substations were located every 8 miles or so along a line, depending on how well the line was built. In later years higher trolley (and in some cases third-rail) voltages were used, one of the principal reasons being to reduce the number of substations needing maintenance.

Often a substation was built at the side or end of some other railroad structure, such as the station mentioned, or under a signal tower. The substation received high-voltage a.c. from high-tension lines leading from a powerhouse; heavier wires at trolley voltage led from it to the poles along the track. At frequent intervals a feeder bridged from the main feeder to the overhead conductor wire itself. Equally heavy feeders were needed to tie in the rails for reverse current flow back to the substation.

In building a power plant or substation on a model line, practically any size or shape of single-story building can be used. Construction was usually brick, although frame, stone, and concrete block occasionally were used. To keep the plan simple, merely run a lead from the building to one of the overhead poles; to detail it, put the transformers and other equipment inside a wire enclosure behind the building, as in fig. 7. Either method is strictly prototypical, which is a break for both the lazy modeler and the one who can never find time enough to work on his layout.

Another form of power plant found on many interurban lines was the portable substation, usually nothing more than an old boxcar containing a small rotary converter and a switch panel. Its chief advantage was that it could be moved quickly to points of poor voltage supply or extra-heavy traffic, or to assist after station breakdowns. Preparing one for model service is quick and easy: Letter "Portable Substation" on an old box car, park it at the end of a single-track siding, block the wheels (sometimes wheels were removed and the body blocked up where extended use was planned), and hook it up to the transmission lines on the overhead poles. It's ready for business. Detailed drawings for a portable substation of this type appear in another part of this book.

Interurban routings

Now let's talk about the routing of the interurbans.

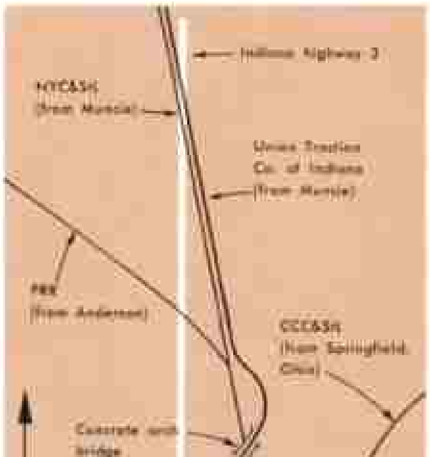


Fig. 12. UT bridges at New Castle, Ind.

City lines do not fall into the interurban classification, but in order to reach their terminals nearly all interurbans traversed street trackage, either their own or that of the city street railways. The typical line used by an interurban was a double-track car line from some point near the city outskirts to the downtown terminal. In order to accommodate the wide interurban cars, some city lines had to be rebuilt with wider track spacing. Interurbans also entered town on single-track lines. Sometimes the local cars had instructions to take siding at passing tracks to let the big cars pass. In rarer instances interurban or city tracks followed close to the curb of the street.

Sometimes poles were placed in the street, usually between the tracks when there were two tracks, with brackets to support the overhead wire. This was a great hazard to wagons and buggies — and later automobiles — so poles were placed along each curb, with span wires instead of brackets. In some very wide streets (and this was common practice in the suburbs of Los Angeles) the poles were left in the middle and curbs were built on either side of the tracks to form a center strip and keep highway traffic off the car line entirely.

The interurbans of Indiana almost universally used wyes or loops to turn cars. This practice was duplicated in a number of other regions even though double-end cars were the usual type used. Even the lines equipped with double-end cars preferred to use loops to turn cars in downtown areas, usually making the loop by circling one or several city blocks. Smaller loops on company property were common in Indiana cities.

Somewhere near the edge of town the interurban swung away from the city car line, either into a fenced right of way that looked very businesslike or to quite the opposite, casually following the curves and dips and rises of a country road.

In the open country, trackage and road-bed varied in size and quality from a single "rusty, wriggly, weed-grown strip of iron" to three- and four-track heavy, well-ballasted main lines. The most common type was the single track of 70-pound rails, cinder-ballasted, with passing sidings located every 3 or 4 miles. These sidings were usually

Bass Photo, collection of Jerry Marlette

Interurban railroads used no more earth fill than necessary, even to cross steam-railroad tracks. This combination substation/interlocking tower was built where THI&E crossed the Monon southeast of Frankfort. Note coiled feeder connection to overhead wire.

double-ended, with trailing-point spring switches and with a capacity of four to six cars. Two- to four-car single-end sidings were also used, mostly for spotting cars at cattle pens or other loading points rather than for regular train meeting points.

Overhead construction

Overhead construction was principally single bracket arm, fig. 8, but with span wires on curves and multitrack lines as in fig. 9. On sidings, the general practice in Indiana was span on the main line and bracket arm on the siding, although span and double bracket arms were used by many lines. While by no means universal, more than one wire sometimes were used over the track in order to augment the feeder wires or make them unnecessary near the end of a branch line. Three wires are seen in fig. 8. Two are for the main line and the third is for the short spur. At a stub siding such as the one in this view, the conductor had to lower the trolley pole and replace it on the siding wire before going in. This type of construction made frogs unnecessary in the trolleywork at passing tracks and other sidings.

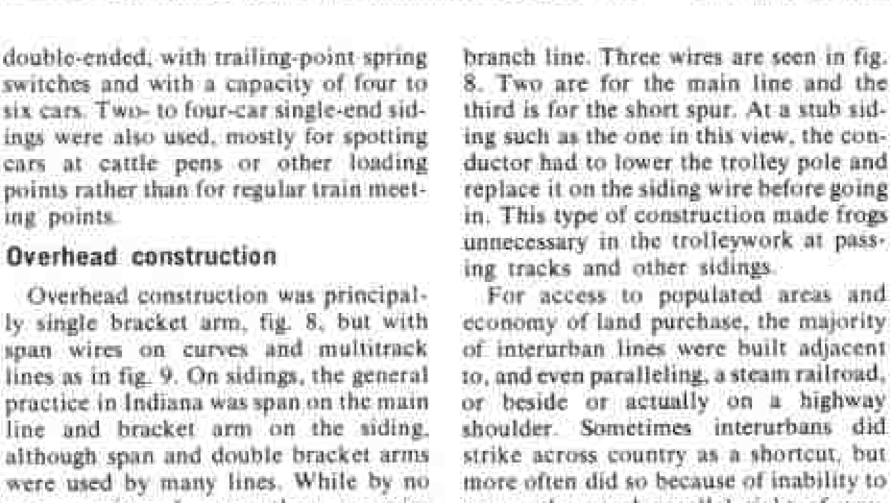
For access to populated areas and economy of land purchase, the majority of interurban lines were built adjacent to, and even paralleling, a steam railroad, or beside or actually on a highway shoulder. Sometimes interurbans did strike across country as a shortcut, but more often did so because of inability to secure the usual parallel right of way.

The side-of-the-road lines entered villages by the simple expedient of swinging over to the center of the road at the edge of town, fig. 10, while those alongside steam roads swung over to the nearest parallel street and down the center of that street through town. See fig. 11. This was necessary because a number of properties, some owned by the steam railroad, were too highly developed for the interurban company to consider condemning them for off-the-street trackage. However, in the newer or poorly developed towns there were instances of private rights of way straight through town. In a few cases the interurban had to resort to some unusual maneuvering to enter a town.

An interesting example is in fig. 12. Coming south from Muncie along the east side of the Nickel Plate, the Union Traction line first swung slightly to the east, then west above the NKP on a viaduct. Next it had to run far enough southwest to line up for another viaduct across a line of the Big Four.

Highways were less of a problem. They were almost always crossed at grade, and at any angle. Protection was the standard wooden "T" or "X" marker, although some roads did have electric flashers and even, in some cases, crossing gates.

A careful application of the prototype principles outlined, when applied to the planning of a model interurban system, will result in a line you can be proud of. It will be historically accurate and technically worthy to carry on the grand tradition of its real-life ancestor.



Bridge and underpass layout of Terre Haute, Indianapolis & Eastern at Cartersburg.

Collection of C. T. Stoner.

Indeed a classic car was Toledo & Western No. 6. Polished wood and delicate pinstriping made this car a most handsome vehicle.

Interurban equipment

Traction lines had a surprising variety of rolling stock

BY STEPHEN D. MAGUIRE AND MIKE SCHAFER

INTERURBANS evolved from electric street railways. When trolley operation in cities and towns became successful during the 1890's, the fabulous potential of electric power brought realization that trolley lines could be extended to connect with other cities and at the same time bring electricity to rural homes. Electric cars offering fast and frequent service could compete with parallel steam railroads. In addition, intercity electric railways would provide better transportation to rural areas, in contrast to the travel on rough, dirt roads. And so the interurban was born.

The interurban era lasted from the late 1890's until about 1930, although growth had stopped by 1912. After World War II most of the few remaining electric lines ceased operation. In spite of a relatively short life span (about three decades), interurbans experienced phenomenal growth before World War I and expanded throughout large portions of the country, especially in the Middle West where land topography made construction possible at minimum expense. But it was during electric railway development that the internal combustion engine was being perfected, and one by one the motor cars, jitneys, and early busses appeared on the very streets and highways that paved the way to doom for traction lines everywhere.

Interurban lines that relied solely on passenger traffic were vulnerable prey to highway competition from the start. Those companies that had the foresight to also carry freight and express often were more fortunate. Freight and baggage operation was especially dominant in the Midwest where many connecting interurban lines formed their own freight interchange service and packaging agency. Electric lines such as Sacramento Northern, Illinois Terminal, Chicago South Shore & South Bend, and the Fort Dodge, Des Moines & Southern developed a large amount of freight business that added to their life span.*

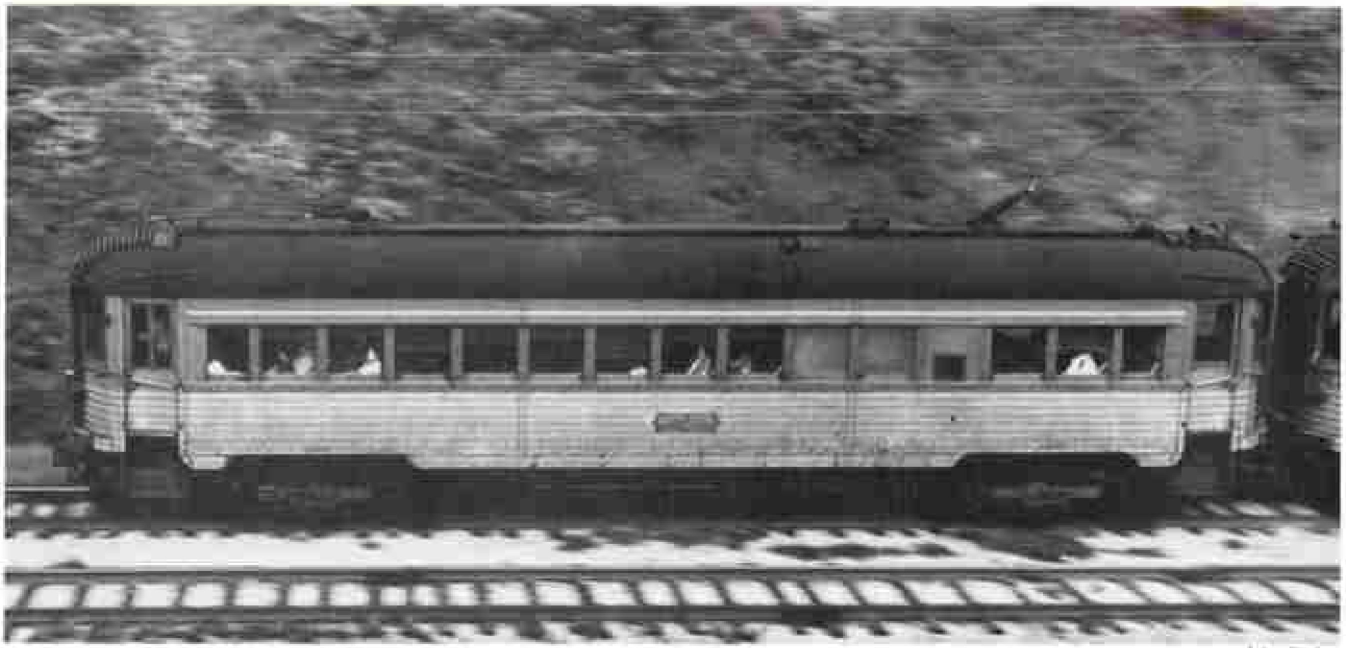
The *Electric Railway Dictionary* of 1911 defined an interurban car as "Any electric car used in long-distance, high-speed service, as distinguished from city and suburban cars." In simplest classification, interurban equipment consists of powered and non-powered passenger cars, box or express motors and heavier electric locomotives, and special rolling stock. The latter includes parlor cars, diners, sleepers, baggage cars, and work equipment. The amount of equipment found on an electric line depended on the railroad's size — some "interurban" lines never got as far as electrification, but instead used gas-electric cars and even automobiles on flanged wheels as their passenger equipment!

Equipment construction

The classic interurban car as envisioned by most fans of traction is the clerestoried-roof, wood-sheathed car typically found on interurban systems during the first decade of the century. Many of them matched the elegance of steam-road passenger equipment. The upper sashes of their large, arched windows often were resplendent with stained glass; car interiors favored rich-colored polished woodwork, and plush seats gave a final touch of elegance. No doubt such a car displayed a highly polished paint scheme with delicate lettering, scrollwork, and striping.

Earlier interurban cars were of composite construction; that is, they were built with a combination of wood and metal structural members (but mostly wood). However, in 1910 a long chain of serious head-on collisions resulted in

*The four interurban lines named are still operating, although only the South Shore Line remains electrified and operates passenger service. The rest have been dieselized, and many have become subsidiaries of other railroads. SN is part of the Western Pacific; FtDDM&S has been absorbed into the Chicago & North Western Transportation Company; and even the CSS&SB is owned by a larger railroad — the Chessie System (C&O/B&O). Illinois Terminal is owned by nine different railroads.



John Gruber

This North Shore "Silverliner" coach is an example of a double-end closed car, with vestibules, controllers, and poles at both ends.

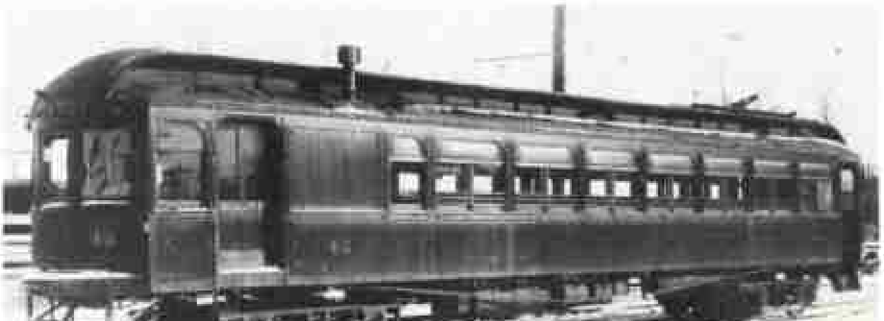
telescoping cars and numerous deaths, and interurban companies — like steam railroads — finally began to realize a need for safer equipment. All-steel underframes on wooden-bodied cars came into use for a short time, but soon every car being built was of all-steel construction. Many lines upgraded their wooden equipment by sheathing it in steel.

The exterior lines of interurban cars were not changed drastically at this time, although arched windows with stained-glass upper sashes (popular around the turn of the century) began to give way to squared-off lines after 1917. Eventually roof styles also changed. Clerestory roofs with fancy glass insets disappeared and were replaced by the simple but more structurally sound (and leakproof) arch roof. In a few instances the old clerestory roof style was retained, even as late as 1923. Cars built for the Cincinnati, Lawrenceburg & Aurora; Coral Gables Rapid Transit; and the Columbus, Delaware & Marion retained this railroad-type roof long after it had gone out of general use.

Interurban cars were either single- or double-ended. The former had a motorman's compartment at only one end of the car (although some had a small control stand at the rear of the car for occasional back-up movements). Single-ended cars were prevalent during the early days of the interurban era, but their use on latter-day systems was usually kept to lightly trafficked lines. Double-ended cars, with their control compartments at both ends, became popular because they did not require loops or wyes at turnaround points; however, they also were necessary where heavy traffic called for cars to be operated in multiple. Such operation was made possible with the M.U. (multiple unit) controller

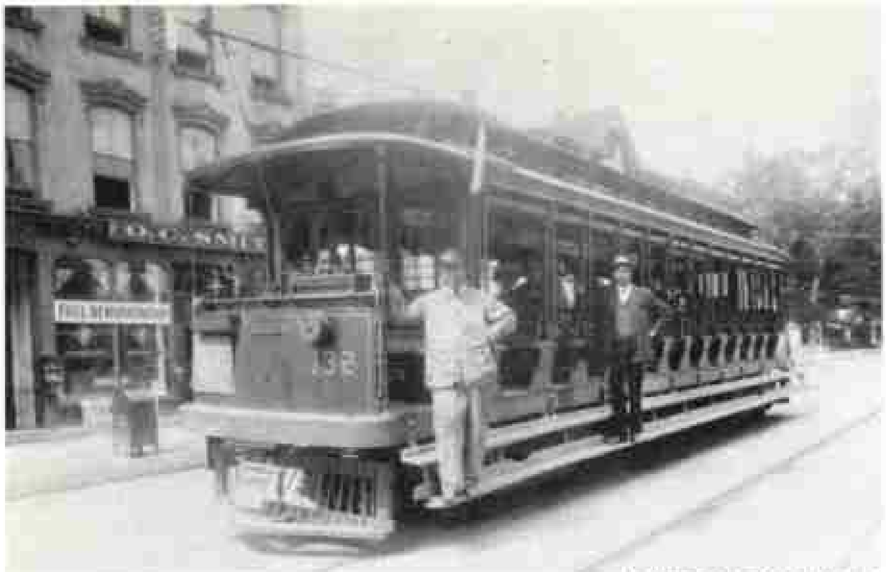
Collection of William J. Clouser

C&LE No. 110 is a single-end closed car of lightweight design, built in 1930 by the Cincinnati Car Company. The cars were built mostly of aluminum and could attain 90 mph.



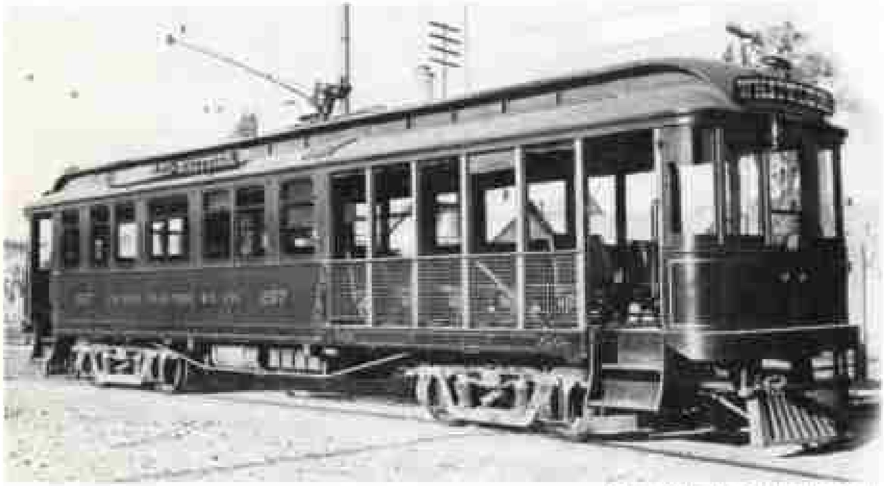
Collection of George Krambles

Combines were popular on most electric lines. Laconia Car Company of Laconia, N. H., built this well-proportioned combine for the Terre Haute, Indianapolis & Eastern in 1906.



Collection of Stephen D. Maguire.

Hudson Valley Railway open car 132 poses on the streets of Glens Falls, N.Y. Abandoned in 1928, Hudson Valley Railway was one of the few interurban lines (as opposed to streetcar lines) that operated open cars. Note the clam-bake poster on the car's fender.



Magna collection, courtesy Ira Swett.

Hundreds of semi-open cars like No. 257 roamed Pacific Electric rails. Eventually many of them were rebuilt and enclosed completely. Note 257's rounded corner windows.

Magna collection, courtesy Ira Swett.

"California cars" featured a closed section placed between two open sections as shown by this Los Angeles Inter-Urban Railway car. The LAIUR actually was an extension of the PE.

whereby several cars could be coupled together and operated from one control stand. "M.U.'ing" became a common practice on interurban systems that operated high-speed trains over relatively long distances in the manner of steam railroads. This type of operation was found on such lines as Lake Shore Electric, the North Shore and South Shore lines, Sacramento Northern, and the Galveston-Houston Electric Railway.

Passenger car types

Closed cars were the most common type of interurban rolling stock. They were built much like railroad passenger coaches, with seats on either side of an aisle down the center of the car. Sometimes the interior of the passenger section was divided into smoking and nonsmoking areas; seats were reversible in double-ended cars. Most closed cars rode on 2 two-axle trucks and ranged in length from 40 to 70 feet and in width averaged about 8 or 9 feet.* The cars had a vestibule at one or both ends, or in the center of the car, and the motorman's compartment was usually located on the right side (Illinois Traction System was an exception with its left-side motorman compartment).

Combines were closed cars fitted with a baggage compartment and a baggage door at one end. The popularity of interurban combines is attributed mostly to traveling salesmen with their trunks of wares, and to roving vaudeville shows with their performance equipment. Besides carrying baggage, combines were useful for handling small shipments of merchandise, newspapers, perishables (such as milk), and other items requiring speedy transportation. A few combines were refitted for Railway Post Office service — for mail-sorting en route — but this was rare. Interurbans did carry large quantities of pouched mail in combines and baggage cars. South Shore Line still was operating express package service with combines into the 1970's between Chicago, South Bend, and intermediate points.

Open cars had only enough wall structure to support an awninglike roof, and passengers rode in open-air comfort — or discomfort if the weather changed suddenly (although some cars carried roll awnings). These cars had bench-type seating that usually extended the full width of the car. There were no doors as such, and the steps ran the full length of the car enabling passengers to alight at any point. The dangers of open-car operation at speed prevented most companies from using them, although a few lines such as the Hudson Valley

*For clearance reasons 8'6" was the most common width for streetcars and interurbans, however Sacramento Northern; Fort Dodge, Des Moines & Southern; Illinois Traction System; and Waterloo, Cedar Falls & Northern took advantage of the fact that they followed steam road standards (because of the large amount of interchange freight service they were involved in) and built their passenger cars to 10-foot widths.

Railway, Boston & Worcester Railway, and the Dayton, Covington & Piqua did operate open cars as interurbans.

Semi-open cars proved quite popular on Southern California traction lines. In addition to a regular closed section, there was open-air seating at one end, or sometimes at both ends of the car (those that had open seating at both ends were nick-named "California cars").

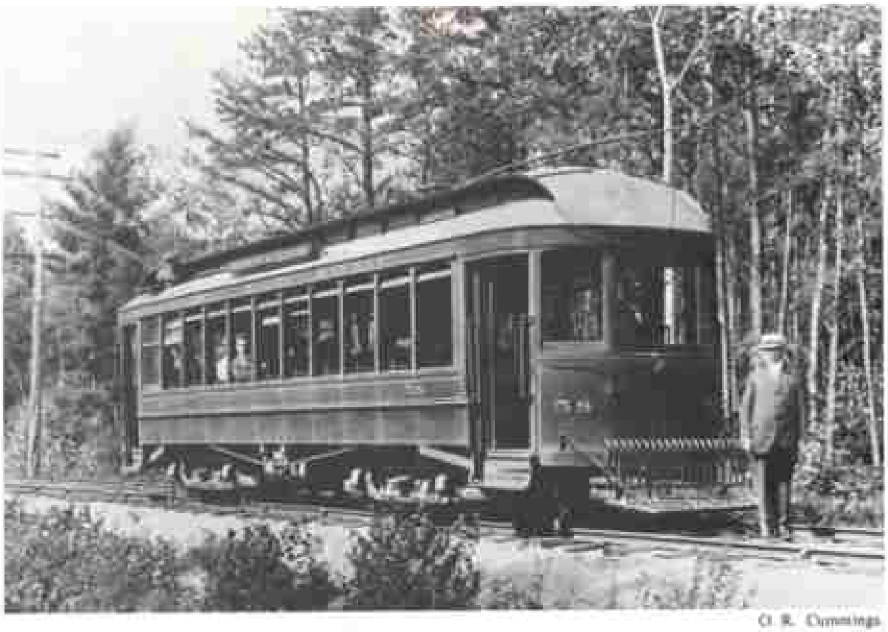
Semi-convertible cars could be used either as closed cars or as open cars by means of window sashes that dropped into special pouches in the car sides. This solved the problem of year-round operation that semi-open cars had.

Convertible cars also were adjusted to be closed or open: When open, the windows were removed completely from the cars and stored.

Center-entrance cars, as the name implies, had entrance doors located near the middle of the car, as well as at one or both ends of the car. The center door and the step landing usually were lower than the main car floor, making it easier to board. Also, center-entrance cars could be loaded and unloaded faster.

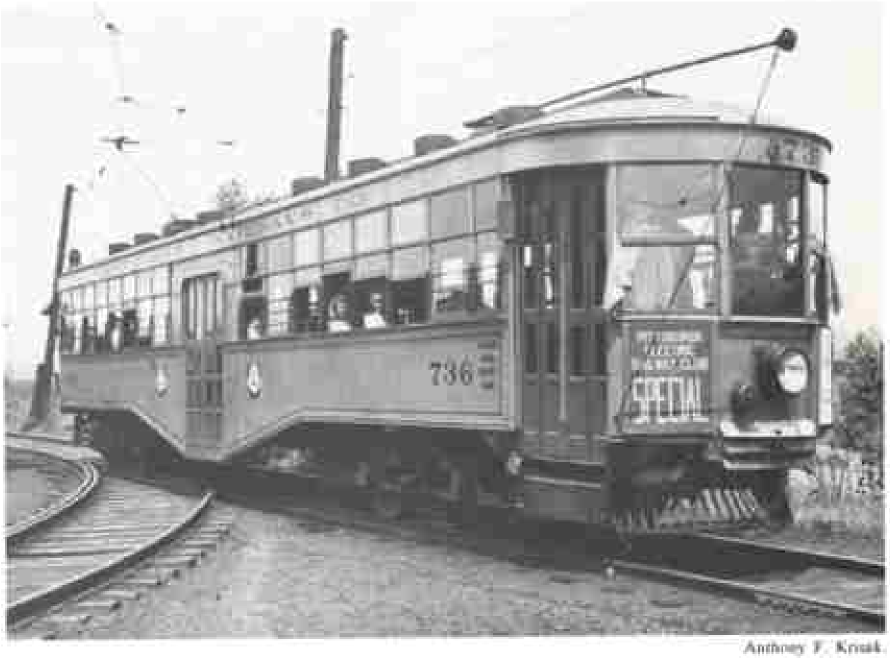
Articulated cars were tried on only a few electric lines, notably on Milwaukee Electric Lines and San Francisco's Key System. Most articulated cars resembled two regular passenger-carrying coaches coupled closely together. However, the two "cars" rode on a common truck at the point of articulation. A diaphragm between the two sections protected passengers moving from one half of the car to the other. Articulated cars were designed to carry high-capacity loads and yet be able to negotiate tight curves of city street trackage. They were economical to operate because one conductor could handle both sections; also, articulateds used less power than two regular cars operating together.

Lightweight interurban cars. Around 1917 smaller traction motors were developed for interurbans. Smaller motors permitted the use of wheels of a smaller diameter, thereby lowering the car's center of gravity. Using this technology, carbuilders Brill, Kuhlman, St. Louis, and Cincinnati introduced lightweight



O. R. Cummings

Atlantic Shore Railway 58, photographed near Kennebunkport, Me., in the early part of the century, is a semi-convertible car. Its windows folded into pockets in the upper sashes.

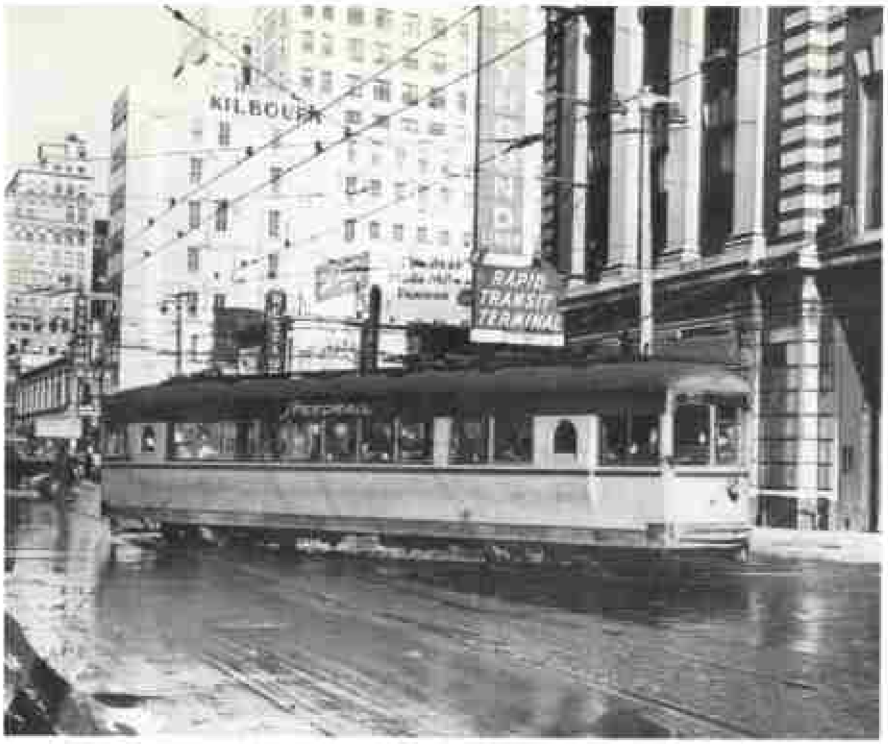


Anthony F. Krisak

"Sow bellied" center-entrance car 736 of the West Penn Railways was photographed near Uniontown, Pa., in May 1948 during a special trip for the Pittsburgh Electric Railway Club.

Collection of George Krambles

WB&A's 10 sets of articulated cars raced between the road's namesake cities on schedules competitive with parallel steam roads.



William D. Middleton

Most Milwaukee Rapid Transit & Speedrail runs were handled by Cincinnati-built curved-sided cars, such as No. 60 departing Milwaukee for Waukesha. Formed in 1949, MRT&S was an illfated effort to reorganize The Milwaukee Electric Railway & Light Company.

Kalmbach Books: Harold A. Edmonson

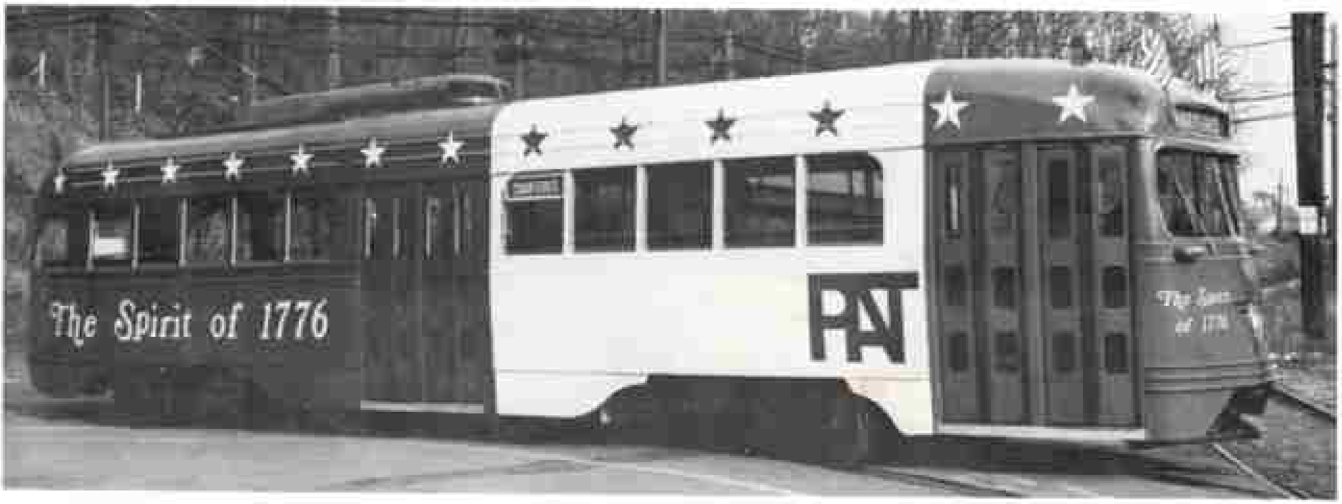
A pair of SEPTA (Southeastern Pennsylvania Transportation Authority) Brill-built "Bullet" cars photographed in late 1972 await call to duty: a 13.5-mile sprint between Philadelphia's 69th Street Terminal and Norristown, Pa. The Bullets were constructed in 1931.

interurban cars during the 1920's. Although economical, these cars were slower and less comfortable than larger interurban equipment.

Lightweight cars that could match the performance of older, heavier equipment in terms of comfort and speed didn't arrive until 1930. Cincinnati Car Company's curve-sided lightweights proved extremely popular in the interurban era and gave many electric lines a second wind after interurban business began to decline shortly after World War I. Cincinnati's patented method of construction utilized specially curved car sides to add strength and balance to the car without additional weight. Brill Company's aluminum-bodied streamlined "Bullet" cars also were popular with several lines.

Interurban streamliners. Few interurban lines tried streamliner-type trains, and only one — Chicago North Shore & Milwaukee — encountered any degree of success with its streamliners. North Shore's famed *Electroliners* (two sets) were delivered in 1941 by St. Louis Car Company for service between Chicago and Milwaukee. It wasn't until about seven years later, in 1948-1949, that three more interurban streamliners were built, this time for the Illinois Terminal. Also built by the St. Louis firm, they were not articulated like the *Electroliners*. IT's streamlined trains had the distinction of being the last heavy interurban cars ever to be built.

Special service cars. Dining, parlor, sleeping, and observation cars fit this category. Although many cars of these types were common on interurban lines in earlier days (as they were on steam railroads), few were truly successful, since most lines were not long or busy enough to justify such special services. Of course, there were exceptions: SEPTA's *Liberty Liners* (formerly North Shore's *Electroliners*) became noted for providing refreshments — even into the 1970's — on the 13.5-mile run between Philadelphia (69th Street) and Norris-



In 1973, lightweight PCC car 1776 of Pittsburgh's transit system appeared in red, white, and blue to commemorate the U. S. BiCentennial.

town. Illinois Terminal operated sleepers as late as 1940 (only three electric lines offered sleeping car service to any extent: Illinois Terminal; Oregon Electric; and Interstate). Most of the larger interurban companies owned private cars for official use. These specially built cars had complete dining and bedroom facilities. Most special-service cars were trailers.

Trailers were non-self-propelled cars hauled behind powered coaches. Many trailers were parlor cars, diners, and sleepers (*i.e.*, cars not likely to be used in service by themselves), but most were coaches. Aside from economy, and because they were non-powered, trailers had the advantage of having less noise and vibration (although a few interurban lines equipped some of their trailers with powered *trucks* that could be operated from adjacent powered cars). Trailers for carrying freight and baggage also were common on many electric lines offering intraline freight service. They usually were hauled behind a box motor.

Freight equipment

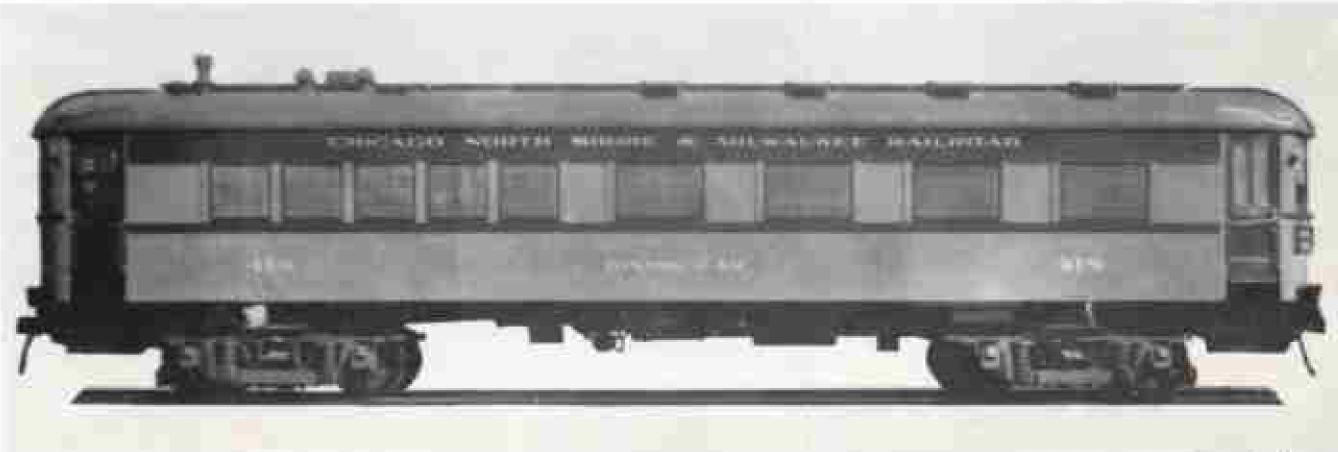
Box or express motors resembled interurban baggage cars fitted with trolley poles, motorman's controls, and windows on the ends (many express motors were converted from interurban baggage cars). Express motors, often with the aid of a baggage trailer, were popularly used to transport small shipments of intraline freight. Because they usually were too light, box motors seldom were used to handle large loads of regular railroad freight cars in interchange service. Interestingly enough, Illinois Traction System, Piedmont & Northern, and the Oakland, Antioch & Eastern used their box motors to power passenger trains.

Steeplecab freight motors were widely used by electric lines, especially those that engaged in a large amount of interchange freight business. Although a number of manufacturers — notably General Electric and Baldwin-Westinghouse — built steeplecabs, all

John Pickett.

North Shore's 156-foot articulated Electroliners (above) were built to negotiate street trackage in Milwaukee and the tight curves of Chicago's "el," yet could hurtle at 100 mph on open main line. After CNS&M abandonment in 1963, the Electroliners became "Liberty Liners" (below) on Philadelphia's Red Arrow Lines (now SEPTA).

William D. Middleton.



Catenary Productions

Most special-service cars were trailers, like CNS&M diner 418, although North Shore did own powered diners. The wide-windowed car was built by Pullman in 1928 and served until North Shore dining service ceased (except on Electroliners) in 1949.

Collection of William J. Clouser.

Collection of Stephen D. Maguire.

William C. Janssen.

Other types of special-service cars included sleeping, parlor, and observation cars. Illinois Terminal sleeper Edwardsville (top) served on the Peoria-St. Louis Owl and featured upper-berth windows. Interior (left) of Illinois Terminal streamliner shows parlor section. (Above) Observation car Carolina trails a Piedmont & Northern passenger train powered by a box motor.

Eugene Van Dusen.

Bound for Notre Dame University in South Bend, an 11-car Chicago South Shore & South Bend football special speeds along the snow-dusted sand dunes of northern Indiana. Almost every other car of the orange-and-maroon train is a coach trailer.

Henry J. McCord

Cedar Rapids & Iowa City (The "Crandic" Route) box motor 51 was built in 1915 by St. Louis Car Company. CR&IC dieselized in 1953.

bore a family resemblance: double trucks; a motorman's cab centered on the carbody; and sloping hoods on both sides of the cab. This design afforded maximum visibility during switching. Steeplecabs varied in weight from 30 tons to 100 tons, but 50 tons was average.

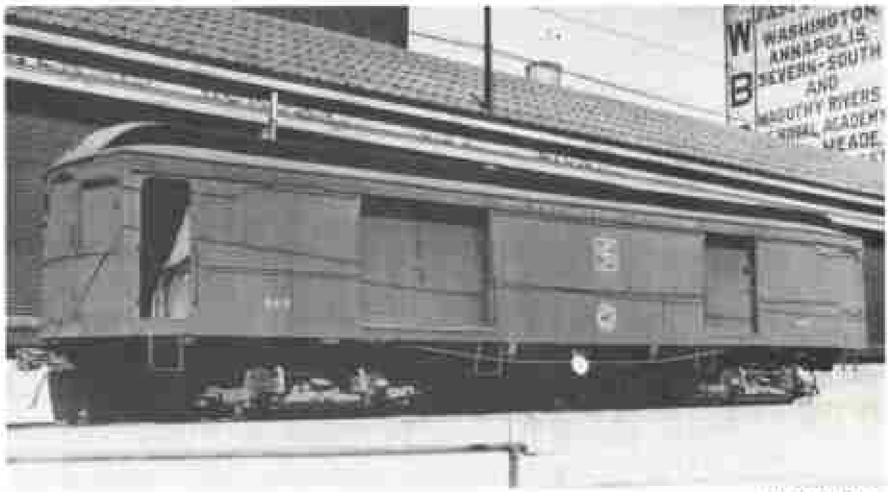
Box-cabs. These units were basically the same in weight and frame size as the steeplecab, but they were box-shaped with a cab at one or both ends. Although widely accepted, they did not prove to be nearly as popular as the steeplecab because of limited visibility during switching.

Articulated locomotives used on electric lines usually were of B-B+B-B (two pairs of two-axle trucks) configuration. More wheels on the rail meant less locomotive weight per wheel enabling these units to operate on light interurban trackage. Articulated locomotives often were delegated to heavy freight movements (interchange freight) over fairly long distances; yet with trucks being mounted on an articulated frame, these large locomotives could negotiate very tight curves found on interurban lines.

Work equipment

Portable substations provided additional power to lines that handled large numbers of extra trains for weekend amusement park and beach crowds, ball game fans, tour groups, and other special-occasion travelers. The substations could be dispatched directly to the line requiring the supplemental power and spliced into local power lines to draw the current needed. Portable substations usually were no more than a transformer and a converter housed in a boxcar body.

Line cars are the most well-recognized type of maintenance-of-way



Bruce D. Fales

This Southeastern Express trailer carried intraline freight on the Washington, Baltimore & Annapolis. Such cars were attached to powered freight or passenger equipment.

Collection of Phillip C. Johnson

Yakima Valley Transportation 298 is a typical interurban steeplecab. The 298, a veteran of 48 years of service when this photo was taken in 1970, was built by General Electric.

Illinois Terminal's five articulated 1800-h.p. Class D's were the line's heaviest freight locomotives. IT built them during 1940-1942.

Collection of Stephen D. Maguire.

Spokane, Coeur d'Alene & Palouse 500 is a Baldwin-Westinghouse box-cab. SC&P was owned by the Great Northern and eventually was absorbed into GN in 1943.

Alex L. H. Darragh.

Portable substations often were dispatched to remote lines of an interurban, but this 1944 view shows a P&N portable substation in use at the road's Greenville (S. C.) shops.

equipment found on trolley lines. They appeared in many variations, but most had some kind of raised wooden (for insulation) platform for crews to stand on while repairing overhead. Many line cars were converted from express motors or baggage cars, while others were no more than a flat car fitted with a shed-type structure that housed tools, spare parts, and coils of trolley wire for patching. Many line cars were motorized.

Other maintenance-of-way equipment included bunk cars (usually converted from old passenger cars) to house crews on duty out on the line, and cars to haul tools, ties, ballasting and rail equipment for tracklaying and maintenance.

Trolley apparatus

Couplers were a problem for many traction lines. Many electric lines employed a simple coupler system such as the Van Dorn, or a tightlock coupler system such as those made by Tomlinson or Westinghouse. When interurban lines began interchanging freight with steam roads, it was necessary for them to adopt the railroad MCB (Master Car Builders) coupler, but this was not always so simple. MCB knuckle couplers, as they were used on steam railroads, could not be used on tight-curved, irregular trackage of interurban lines without being modified. In many cases they also had to be modified to mate with interurban-style couplers. Some manufacturers developed fully automatic systems for interurban lines whereby electrical and air connections were made upon coupling.

Pilots and fenders protected cars by brushing aside large foreign objects from the rails. Earlier interurban cars had large rakelike fenders usually made of wood, many of which were capable of brushing aside stray pedestrians if they had to! When M.U.'ing became common practice, large protruding fenders disappeared. Later pilots were steel, although somewhat smaller. A few lines tried pilots shaped from sheet metal (which could be used as snowplows if necessary), but these proved unpopular be-

cause they prevented air from cooling the truck motors. It became more practical to replace regular pilots with snowplows during winter. Many interurban companies had rolling stock with no pilots at all. An interesting note: Some urban areas had ordinances demanding that city cars be equipped with fenders, and there were even instances when interurban cars, upon entering the city, had to attach fenders that would meet city requirements (even if they had a fender or pilot of another type).

Anti-climbers were special sections of forged, rolled steel riveted to the car end sills. They were designed with the theory that should two cars collide, the ridged projections would interlock and prevent the cars from telescoping one another.

Headlights. High-voltage carbon-rod arc headlights were commonplace during the early days of the interurban era. These lamps could not be dimmed, so incandescent lamps soon became the popular means of illumination for headlights. Most headlights were portable and were mounted at some point near the center of the car front, or at roof level, and sometimes at both locations. Most interurban cars also were equipped with marker and classification lights.

The **catcher/retriever mechanism** usually was located towards the center of the car front and near the motorman's window. The catcher's pull on the trolley rope was 4 pounds less than that of trolley pole tension against the wire — just enough to keep the rope taught. The retriever exerted a pull of 70 pounds of pressure on the trolley pole rope which, by means of a special trip device, would pull the trolley pole all the way down in the event of a dewirement. Retrievers were especially necessary for high-speed cars because they greatly reduced damages that might occur to over-

Catenary Productions

CNS&M 604 was a line car equipped with a special derrick that served as a posthole digger and a pole setter. The car was built in 1914 by the Chicago & Milwaukee Electric Railway.

Henry J. McCord

Bruce D. Fales

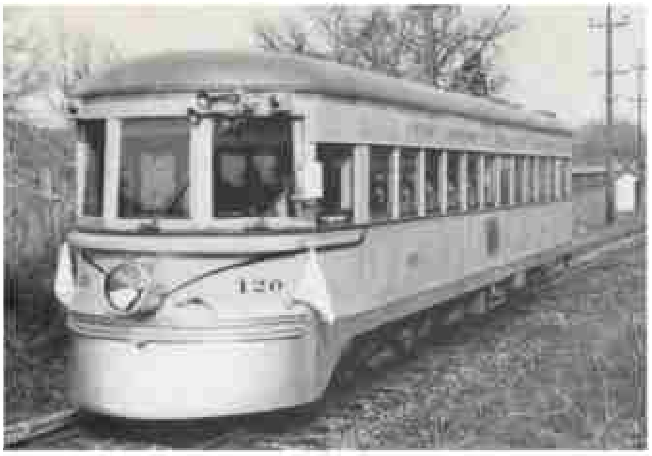
Illinois Terminal box cars had jointed MCB couplers (left) so equipment could negotiate tight curves. Some electric lines used couplers that automatically made air and electrical connections (above).

Dave Borchler

Nose of Columbus, Delaware & Marion parlor car shows metal fender, anti-climber, and catcher/retriever below right window.

William D. Middleton

Fort Dodge Line 72 has a snowplow and — as required by Iowa law — a high-mounted headlight and steam-locomotive-type bell.



Cedar Rapids & Iowa City 120 (ex-Indiana Railroad 65), photographed in 1944 near Cou Falls, Ia., had a sheet-metal pilot.

H. L. Kelso

This PE car displayed the destination on a roof-mounted roll sign, and intermediate stops on a metal sign below the front window.

William D. Middleton

The roof mat on this North Shore car prevented roof damage if the trolley pole dewired and was snapped down by the retriever.

Donald C. Allen Jr.

Sacramento Northern 302 shows extended pantograph. SN was one of a few interurbans to use a pantograph collection system.

head in high-speed trolley dewirements.

Roof mats were the latticelike attachments (usually made of oak) on the roof ends. Although not all cars were equipped with them, mats protected the car roof from dewired trolley poles snapped down by retrievers.

Destination signs, usually printed on boards or metal sheets, were attached to the car at any number of positions, but most often below the front window or in the window itself. A number of lines mounted the destination signs on the front of the roof. In later years, roller destination signs found wide acceptance on electric lines.

Horns, whistles, and bells. Horns and whistles were situated on the car ends or on the roof; most were air-operated. Bells and gongs were operated by ropes, foot pedals, or air pressure. Some interurban lines — Fort Dodge, Des Moines & Southern for one — mounted actual steam locomotive bells on their electric cars (Iowa lines were required by law to do so).

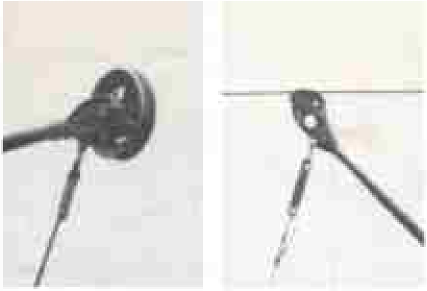
Current collection systems

Trolley poles are a well-recognized item of traction apparatus because they were by far the most popular means of current collection for interurban lines in North America. The trolley pole, which averaged 12-14 feet in length, and its trolley wheel were held against the overhead wire with about 28 pounds of pressure applied through a swiveling, spring-loaded trolley base mounted on the roof. Trolley wheels were replaced every few hundred miles owing to wear, and on many lines eventually were substituted with a sliding shoe pick-up. Shoe pick-ups were more durable and made better contact with the overhead wire.

Pantographs. Trolley poles were limited in the amount of power they could draw, whereas the wide, flat sliding collector of the pantograph could draw a larger amount of current. Pantographs were raised by springs and

lowered with air pressure. Few interurbans used pantographs, because they were really necessary only for heavy-duty service with a.c. electric power such as that found on electrified railroads. South Shore Line and the Denver & Interurban Railroad were two exceptions. Pantograph collection required a slightly different type of overhead construction. The path of overhead wires had to be staggered about 6 inches to either side of the center line so that the wire would not wear a groove on the flat surface of the collector shoe. Also, the use of trolley frogs over switchwork was unnecessary because pantographs merely made contact with the overhead wire and were not guided by it as were trolley wheels and shoes.

Third-rail collection was ideal for heavy-duty lines, and often less expensive than overhead systems. The Chicago Aurora & Elgin, North Shore Line, Philadelphia & Western, Northern Electric, and the Scranton to Wilkes-Barre (Pa.) Laurel Line used third-rail collection on at least a portion of their lines. CA&E and CNS&M equipment was equipped for third-rail collection because their cars entered downtown Chicago via Chicago Transit Authority trackage. North Shore primarily was trolley-operated, but CA&E was third rail throughout most of its lines. (Sacramento Northern cars sometimes had to use all three forms of current collection, and much of the line's equipment was fitted with pantographs, trolley poles, and third-rail shoes!) The collection shoe on third-rail equipment was attached to the truck of the car to slide along a third rail built — slightly raised — parallel to the running rails.



Two of the most common types of trolley collectors were the wheel (above left) and the sliding shoe (above right). The shoe usually proved more reliable and eventually replaced wheel systems on many lines.

Kalmbach Books: Harold A. Edmonson

This closeup shows a third-rail collector shoe on a SEPTA Bullet car.

Donald Sims

A four-car Chicago Aurora & Elgin train (above) rumbles above the south train sheds of Chicago Union Station in April 1949. Note the inbound elevated train at right.

Donald Sims

CA&E was one of a few lines that used third-rail collection extensively; only a few segments of the system had overhead. This CA&E train arriving at Wheaton in 1949 has two of the line's 1945-built fishbellied cars in its consist. CA&E was abandoned in 1961.

All photos, MODEL RAILROADER: A. L. Schmidt.

Build a trolley car

Using readily available parts and materials, the Milwaukee & Rockford Electric Railway constructs a handsome addition to its fleet of steel interurban cars

BY MIKE SCHAFER

KA-THUM-thum-thum-thump. The noise of the air compressor could be heard through the shuffle of passengers as last-minute patrons scurried towards the classy-looking orange and maroon interurban car. The 8 a.m. departure time neared; the motorman gave a last-minute check for stragglers, clanged the bell, and notched back the controller to ease the heavy interurban car out of the train shed and down the street. A few minutes later it was out in the country-side zinging wire at 70 per, and soon neared its destination at the opposite end of the model traction layout.

It's nice to point at that classy orange and maroon traction car and be able to say, "Yup — built it myself!" One of the finest enjoyments of modeling is building your own equipment, and if you have never done it before, why don't you consider constructing your own trolley car? The experience will provide you with some of the basic skills you will need when building more advanced models and the layouts to run them on.

Choose a design

Your first decision will be to decide what you want to create — or recreate. You may want to build a replica of a specific prototype, or you may, as I have done in this chapter, "custombuild" a traction model for your own electric line. If you are inexperienced in modeling, you may wish to "freelance" your first traction model. This way you can concentrate on construction techniques rather than on trying to duplicate specific lines and details of a prototype — usually a more difficult task and something you might want to save for the future when you have had more practice.

My freelanced interurban was a cross between a scratchbuilt and a kitbuilt model. I used many commercial parts in its construction, but I scratchbuilt the car sides out of styrene. You may want to build more of the parts from scratch on your model than I did on mine — it takes longer, but usually it's cheaper and the resulting components often look better than some commercial parts. Besides, you'll be gaining just that much more modelbuilding experience. By the way, it is entirely up to you, the modeler, whether you want to follow my construction step for step, or simply refer to the article here and there for comparison while building to your own designs and whims.

Before I started actual planmaking, I began making some rough sketches of what I envisioned the completed car to look like. After thumbing through a number of traction books, I conceived a car design that was a composite of traits of some of my favorite interurbans: a TMER&L (The Milwaukee Electric Railway & Light Co.) roof with its characteristic low, wide clerestory; flush-welded car sides such as those found on Chicago Aurora & Elgin 451-460-series cars; squarish windows in pairs, not unlike those of more modern, heavy interurbans on the Illinois Terminal, TMER&L, and CA&E; skirting on the car sides *à la* Chicago North Shore & Milwaukee "Silverliner" cars; car ends similar to CNS&M (although not tapered); CNS&M trucks (by default, since I was going to use a Walthers North Shore power truck kit); and pilots similar to those found on old Pennsylvania Railroad multiple-unit electric commu-

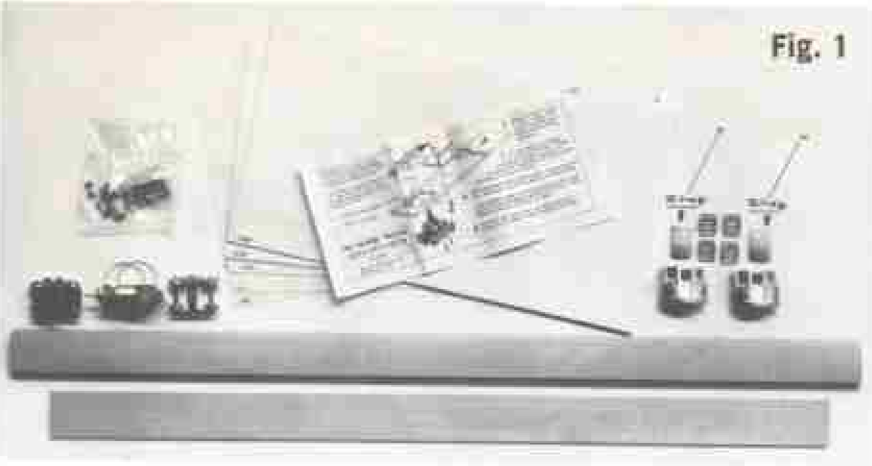


Fig. 1

ter cars. My car was to be a heavy steel interurban car that had been modernized by the railroad in the late 1940's with flush-welded sides, high-speed trucks, and a flashy orange-and-maroon paint scheme. I chose to name my interurban the "Milwaukee & Rockford Electric Railway" ("Milwaukee & Rockford" for short), an imaginary line connecting that famous Wisconsin beer capital on the shores of Lake Michigan with Rockford, a fairly large city 90 miles to the southwest in northern Illinois. The car was to see high-speed service between the railroad's namesake cities.

Materials and tools

The bill of materials for my HO traction car included:

- Walthers U776 North Shore power truck kit
- Wood floor: basswood, ⅛" x 1-5/16" by about 10"
- Walthers M399 interurban roof
- Walthers C556 trolley ends
- Sheet styrene in thicknesses of .010"; .015" (clear — for window material); .020"; .060"
- Kemtron X-955 trolley pole kit
- Walthers C989 North Shore steps
- Walthers C997 roof mats
- Suydam wide-swing interurban couplers
- Walthers C1021 Pennsylvania MU pilot
- Walthers C978 clerestory beading
- Walthers C832 North Shore headlight
- Walthers U774 Skokie coach underbody kit (includes triple valve, brake cylinder, resistor bank, 2 air tanks, fuse box, line switch, reverser, group switch, and compressor)
- Brass strip, ⅛" x ½" by about 2"
- Hook-up wire
- Brass spring wire, .013" diameter
- Construction paper
- Six 1½" 2-56 screws with nuts
- Two 1⅛" 2-56 screws

Do not hesitate to substitute parts with commercial parts of other manufacturers or your own scratchbuilt components. Remember, it is the quality of the finished product that counts — not necessarily the kind of materials used in its construction. Use whatever works best for you.

The following is a list of tools I used in the construction of the car. Those marked with an asterisk (*) are optional, but they will help you do a better job if you can procure them:

- Pencil
- Paper
- Steel model-railroad reference rule
- Scriber*
- X-acto knife with extra B11 blades
- Razor saw*
- Jewelers saw
- Assorted small files (especially flat ones)
- Soldering gun
- Solder
- Rosin flux (see following section on soldering concerning these last three items)
- Assorted drill bits
- Assorted taps (see section on drilling and tapping concerning these last two items)
- Pin vise
- Small electric hand drill (such as a Dremel Moto Tool)
- Tweezers
- Assorted small screwdrivers
- Needle-nose pliers*
- Small vise
- Small "C" clamps*
- Center punch
- Wire cutters*
- Sandpaper
- Paint brushes
- Plastic cement (liquid)
- Epoxy cement

The construction of the model involved more tools than the number of parts, but do not let this deter you from building the model if you are a novice and have few of the tools. Buy tools as you need them; besides, this may keep you from rushing the model to completion, allowing you to do a better job. Most of these tools can be purchased at hobby shops.

Before I begin describing actual construction of the car, I would like to offer some helpful hints about soldering and drilling and tapping. These are modelbuilding skills you'll be using quite often, not only in trolley car construction but also in fabrication of trackwork and overhead.

Soldering

Soldering can be a frustrating job if you have never done it before and have never been told how to do it properly. However, with a little practice you will find soldering to be a useful tool of the trade.

All surfaces to be joined must be heated to a temperature above the solder's melting point so that solder will flow smoothly over the joint. Merely melting solder and applying it like glue to cold surfaces will result in a weak joint (often called a "cold joint"). You should use a flux with most soldering joints; the flux makes the solder flow more readily over the surfaces and at the same time cleans them of oxide and grease. Use only rosin flux for electrical work (or on any parts that will be conducting electricity), and use acid flux with all other soldering jobs.

Start by tinning the iron — heating the tip and cleaning off old solder, carbon, dirt, etc., with a cloth and then melting solder over the surface of the tip. This should leave enough solder on the tip to do several jobs. If possible, clamp together the parts that are to be soldered and apply the tip of the gun or iron to their surfaces. When the melting point is reached, the solder will flow off the tip of the iron and over the joint. Do not apply too much solder. Allow parts to remain motionless while solder "freezes." A good joint will appear to be slightly wet, even after it has fully hardened.

Besides being much stronger, a soldered joint can be done over if a mistake is made, simply by reheating the joint and resoldering. Do keep a few things in mind when soldering, however: If you are soldering a part that is connected to or fitted against plastic, be careful that heat traveling through the part does not melt the plastic. Secondly, make sure that all excess flux is wiped from the joint with lacquer thinner (or wipe it away while it is still melted). Avoid the use of "no corrode" fluxes; the grease in them only slows corrosion and does not eliminate it, and only makes for a more difficult cleanup job after soldering.

Drilling and tapping

Drilling is a modelbuilding process you will be using as often as any. It can be performed with (1) a pin vise, for drilling in soft, thin materials (such as plastic or wood) where accuracy is not of great importance, (2) an electric hand drill, which will handle a majority of modeling jobs, and (3) a drill press, for most accurate results and larger projects.

Mark the hole location with a scriber or pencil point and make a small depression at that point with a punch; this will enable the drill to get an accurate start. If you are using a pin vise or electric hand drill, keep a constant check to see that you are holding the drill perpendicular to the surface being drilled.

Taps are made for cutting threads in holes. After a hole of proper size is drilled, turn the tap into the hole about a half a turn; then turn it back a quarter turn. Repeat this again and again until the hole has been completely tapped. The back and forth rotation of the tap

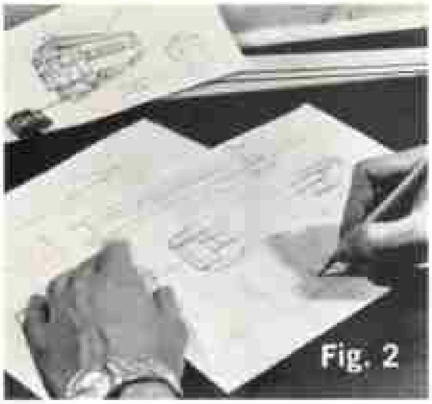


Fig. 2

will allow the chips to fall through the flutes in the tap. Use a little light oil or tapping fluid during the tapping process — it will make for a better thread. If you are tapping a fairly deep hole, remove the tap once or twice to remove chip buildup. Clearance holes are just large enough so that screws of corresponding sizes (refer to the following table) will fit through them without engaging their threads. Clearance holes are used when you want a screw to simply pass *through* a material into the threaded hole of the adjoining material. The following table shows tap sizes (same as screw sizes) and corresponding drill sizes that are most commonly used in modeling:

TAP SIZE	TAP DRILL	CLEARANCE DRILL
00-90	63	55
0-80	55	51
1-72	53	47
2-56	50	42
4-40	43	31
6-32	35	26

Begin construction

Once I obtained most of my parts, I made more-detailed sketches of the car showing side elevations and estimated measurements; see fig. 2. By actually laying the parts out, I was able to make rough estimates of the car's measurement using a model-railroad reference rule. One very important point: Before you start any of the actual model work, study all the parts closely and try to visualize how they will fit together. It might help to make sketches of how tricky joints and parts will lay together. You don't have to be an artist to do these sketches — no one need see them but you! Inevitably, there will be changes from your plans once you get into actual construction, but this is normal.

I started with the floor of the car, first by cutting it to length, and then by sanding it lightly to get rid of splinters and rough surfaces. It is important that the flooring of the car, if you're going to make it of wood as I did, be absolutely flat and unwarped. Otherwise the car will not sit squarely on the track, resulting in frequent derailments and poor electrical pickup. Now mark the location of the truck centers (the point at which the truck is attached to the floor) by doing the following: Measure the width of the car floor and divide the amount in half; then draw a line lengthwise down the center of the floor. Temporarily mark the location of the car steps at the ends of the cars. Set the floor on the unpowered truck (prop up the other end so it is level) and mark the point at which the truck will be able to rotate freely without interfering with the car steps. Keep in mind that the shorter the wheelbase (distance between the truck centers), the sharper the curves that the car will be able to negotiate. Make sure the wheelbase isn't too short, however; otherwise cars will have too much overhang when rounding curves in city streets, and they may clip a few automobiles! Trucks should be located at equal distances from the car ends, and once this point is determined, mark it with a pencil. At this point, I cut a .625" x .875" (15.9mm. x 22.2mm.) opening for the power truck with a very sharp X-acto knife. The hole size will vary with different kinds of power assemblies; there are several types on the market.

Let me cover a few points about cutting various materials with modeling knives. Cuts to be made in wood should be marked with a hard (such as an H-series), sharp drafting pencil. Cuts in plastic (such as sheet styrene) first should be marked with a scribed line (using a scriber or the very sharp point of a modeling knife). With the aid of a steel straightedge, cut the material using *several* firm strokes. Do not try to cut through with one pull of the knife. This dulls the blade and results in a cut that will have rough edges and be very inaccurate. In most instances, you don't even have to cut all the way through the plastic. Only a couple of scores are necessary and then you simply can bend the plastic and snap it off at the score line. The result will be a nice, clean cut.

After the power truck opening is formed, check to see that your unit seats properly in the opening; adjust by sanding or filing. Now assemble your power unit and install it onto the car floor following instructions packed with the unit. Lubricate the gears in the power truck with light grease. At this time, I also installed the non-powered truck by drilling a clearance hole in the floor and attaching the truck with a 2-56 screw and bolts; see fig. 3. NOTE: For better electrical conductivity through the truck and the screw (to which one of the power leads from the motor will be attached) I had to place a segment of spring between the screw head and the bolster; see fig. 4. String a couple of wires from a power pack to the motor leads and give the unfinished carbody a test run.

Car ends

As with almost all die-cast parts, the Walthers C556 trolley ends had to be filed and cleaned of "flash" (extraneous metal on the casting) and filed smooth; see fig. 5. If you have a powered hand drill, the polishing attachments will be especially helpful in getting to those hard-to-reach places. Except when removing large amounts of metal, file lightly with a fine file; you'll find that die-cast metal shapes very easily. Once you feel that the filing is completed, polish the metal surfaces with a soupy mixture of water and kitchen cleanser.

Trolley car ends are parts that could be scratchbuilt if so desired. If you decide to make your own, it might be wise to curve the car-floor ends and build the car ends directly onto the flooring. The cast trolley ends I used had lugs that the car floor fitted between. To hold the trolley end firmly to the floor I used No. 2-56 metal screws inserted through clearance holes in the flooring and into tapped holes in the lugs. Although they weren't absolutely necessary, I added nuts so that the bolts would not unscrew themselves; see fig. 6. Make sure that the car end is exactly perpendicular to the floor so you won't end up with a lopsided trolley! With the car ends attached I then added the pilots. The pilot castings came with a strip of angled metal which I bonded to the pilot with epoxy. I trimmed the angle bar so that it would

Fig. 3

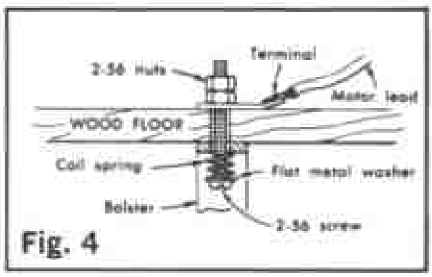


Fig. 4

Fig. 5

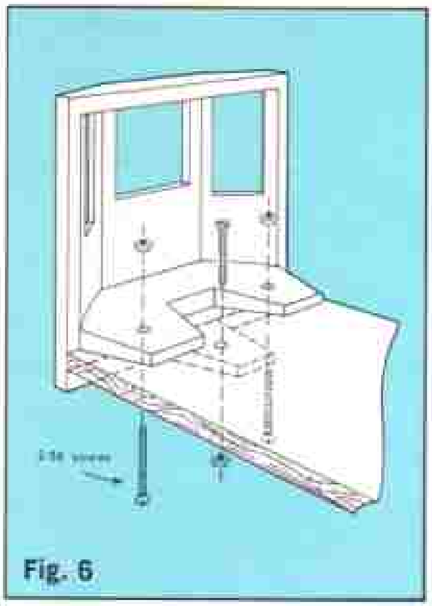


Fig. 6

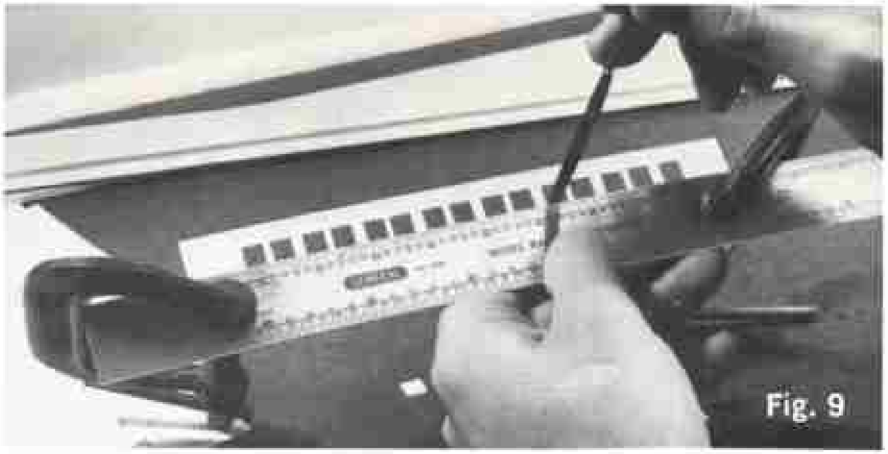


Fig. 9

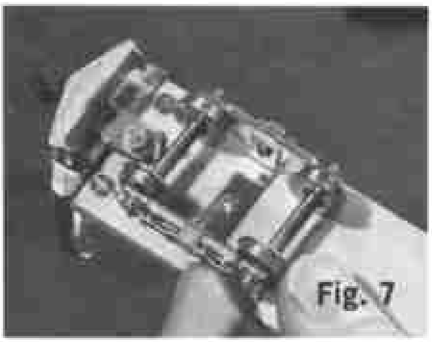


Fig. 7

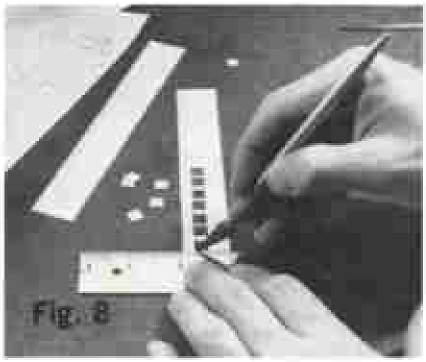


Fig. 8

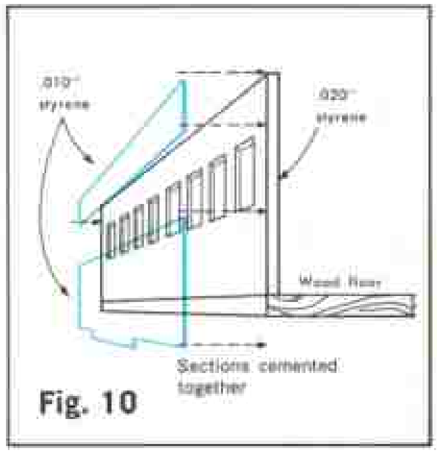


Fig. 10

not interfere with the truck assembly, drilled a clearance hole through it, and mounted the pilot on the same screw that extended through the tapped hole in the center lug of the end casting. The pilot was held in place by a nut; see fig. 7. This was done at both ends since the car was to be bidirectional.

Side construction

I chose to use styrene for the sides of the car, but cardstock or hard-finish Strathmore board (available at art supply houses) of various plies and thicknesses also may be used. If you are modeling an older, wood-sided interurban, you may want to use pre-scribed wood sheathing available at hobby shops. Styrene is a versatile and inexpensive plastic that is especially adaptable to modeling; it is easy to work with, quite strong, and will not deteriorate with age and handling. One of the best properties of styrene is its ability to bond to itself almost instantly through use of liquid plastic cement. Instead of joining parts with glue, the liquid cement actually welds joints together — and in a fraction of the time required for regular cements to set. Construction is speeded up greatly.

By measuring off of the partially assembled car, I was able to determine how the car sides would fit in. I drew them out — actual size — on paper, and figured and marked exact dimensions, window locations, and door positions. I transferred these measurements to .020" styrene, marking the dimensions with the scriber. Next I cut the sides to size and marked in window dimensions. Be as careful as possible that the window measurements are absolutely square. Scribing, measuring, and any other marking should be done on what will be the inside wall of the car. With the tip of a very sharp modeling knife (insert a fresh blade for this step), *carefully* cut the window openings, but cut them slightly smaller than the measurements. Again, do not try to cut all the way through with a single stroke. Use several strokes until you almost cut through the plastic. Then punch out the window openings with the blunt end of your X-acto knife. This leaves a cleaner edge than cutting all the way through. See fig. 8.

No matter how careful you are in cutting the windows straight, they still seem to come out a little askew. This is why we cut them slightly smaller. Clamp your steel model-railroad reference rule to the car sides (using small "C" clamps) along the bottom score line of the window edge. Now, very carefully file the window edges even with a small, flat file using the rule as a guide; see fig. 9. When the rule is removed, the bottom window edges should all be in line. Do likewise for the top line of window edges. By the way, should you need to fill in spots where too much styrene was taken away, body filler can be made by dissolving styrene scraps in a small vessel filled with a small amount of liquid cement. Do not mix it too thin or it will be hard to handle and will deform the plastic to which it is applied.

The car sides were cut from a sheet of .020" styrene. I laminated .010" styrene to certain portions of the car sides to give the sides a three-dimensional quality (as in the prototype). The .010" styrene layer not only served as skirting, but also formed a lip that enabled the car sides to rest on the floor edge; see fig. 10. Laminating is a very simple process. Spread liquid cement sparingly (and quickly) on the surfaces to be welded, allow most of it to evaporate (which usually happens right away), and press the two surfaces together as in fig. 11. Be sure that the pieces are joined accurately the *first time*. Once the two surfaces touch, they are welded permanently and cannot be separated without damage to the plastic. If there are spots that did not fully laminate (usually at the edges), apply cement sparingly to the edge of the joint; capillary action will draw the cement between the two surfaces and, with a little pressure, they will become bonded. Generally, the bonding of the styrene takes place instantly and the parts can be handled normally almost right away — no waiting for glue to dry.

Fitting the car sides onto the body of the car was the next step. I wanted to assemble the sides into a one-unit section so that they could be removed from the

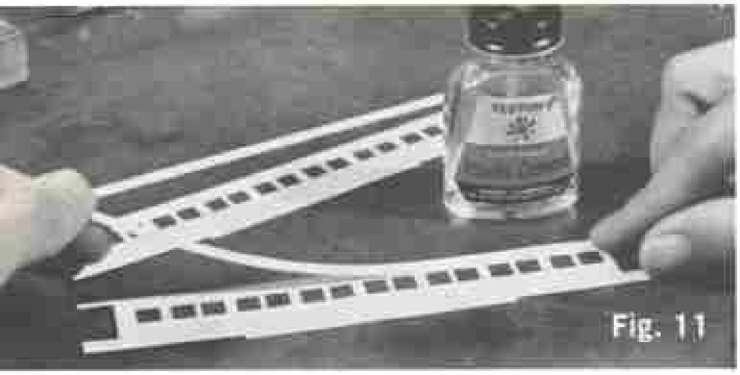


Fig. 11

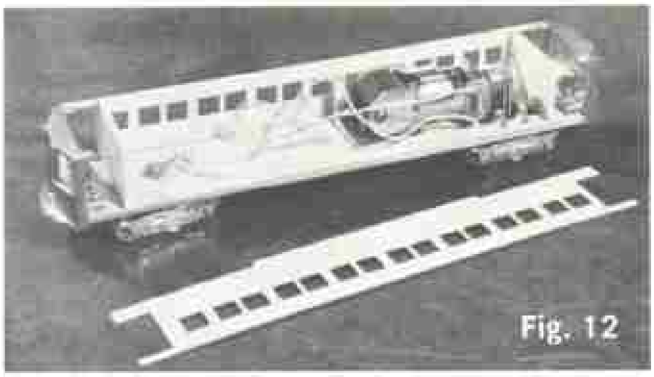


Fig. 12

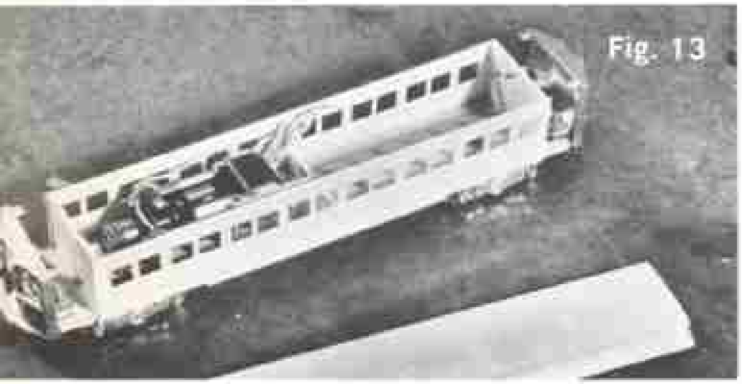


Fig. 13

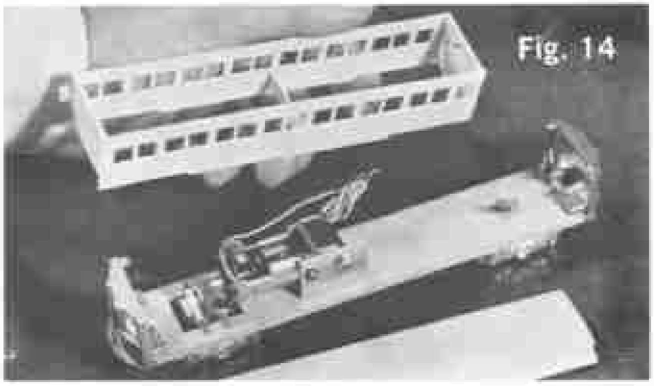


Fig. 14

car floor during construction. This was done with a section of .060" styrene cut (by trial and error) to fit the cross section of the carbody. These cross-sectional members also serve as bulkheads for the interior of the car. I bonded one car side to the cross pieces, allowed it to dry for a minute, and then set the assembly on the carbody to insure that it fit properly; see fig. 12. After attaching the second side, I made sure that the entire assembly sat square on the car floor as in fig. 13. I now had a completely removable set of sides for the car; see fig. 14.

Photos in figs. 13 and 14 reveal where I strayed from my original plans of adding doors to door openings in the car sides. Instead I decided to add full doors, which meant I had to cut off a portion of the ends. I cut the doors from strips of styrene as shown in fig. 15 and bonded them to the car sides. Do not hesitate to make modifications in your plans if it will make construction easier or improve the car's appearance.

Fig. 15

Roof assembly

It is essential that the roof of the car be removable so the motor unit can be maintained. Although the roof should fit snugly without attachments, you can rig a simple system to secure it with screws. First, purchase a strip of 1/8" thick brass and cut it into two sections each about an inch long. These brass sections will receive the 1 1/8" 2-56 screws that come up through the floor of the car. The tricky part is to determine where to locate these screws so they won't interfere with the motor unit or the trucks of the car; yet, the screws should be attached near the roof ends rather than towards the center to insure proper fitting. Once you have determined their location, the procedure is simple: Drill clearance holes in the floor at these locations and insert one of the screws up through the floor. Next attach the brass plate to the end of the screw (making sure that the screw does not protrude through the brass plate). On the underside of the roof, position the brass plate so that the screw will be aligned straight up and down; mark the plate's position with a pencil. Before gluing the plate to the roof, drill a hole — slightly larger than the screw — in the underside of the roof at the point where the screw may protrude through the plate (don't go all the way through the roof!). Now attach the plates with epoxy — this must be a very strong joint; see fig. 16. The roof may be attached once the epoxy has hardened. For a cross-sectional view of this particular roof assembly, see fig. 17.

The shaping of the roof ends is the next step. This seems to be one of the more troublesome phases of modelbuilding because it involves a little sculpting. If it will help, study photographs of roof ends of clerestoried interurban and railroad passenger cars. You may find that simple arch roofs, such as those found on Illinois Terminal cars, are much easier to shape. I cut the roof end roughly to shape with the modeling knife and then sanded the edges. I used Walthers die-cast roof beads to bring the clerestory lip down in a curve; see fig. 18.

Details

Now the trolley is beginning to look like a trolley! It's time to add car steps, roof mats, underbody detail, and the trolley poles. I disassembled the roof and sides while working on the underbody so as not to damage them. Underbody details can be scratchbuilt very easily using wood and metal scraps; however, I chose to use a Walthers underbody detail set made for their North Shore Line car kits. Refer to photo-

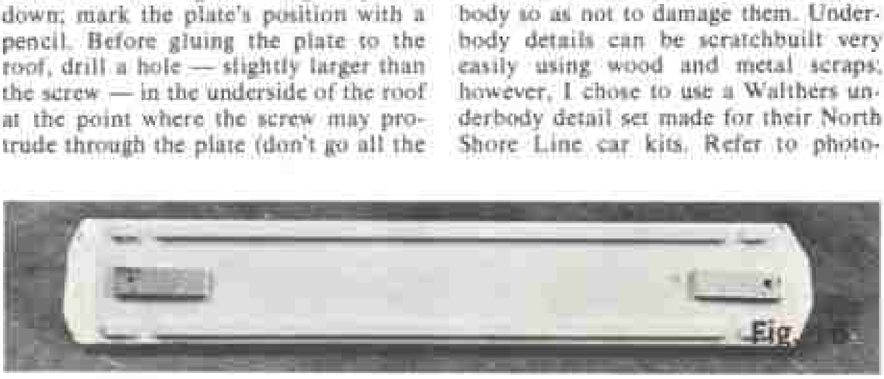


Fig. 16

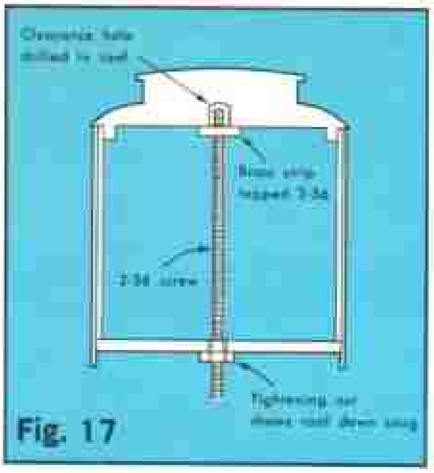


Fig. 17

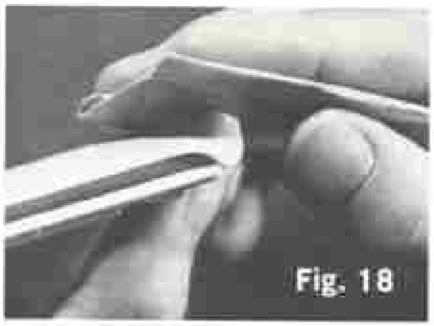


Fig. 18

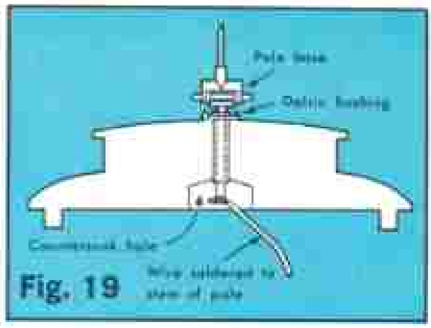


Fig. 19

graphs and traction car plans for location of these details.

Again, the modeler has a choice to make when it comes to deciding what brand of coupler to use. Whatever the choice, you should standardize on one type of coupler for your entire traction system so you can run cars together. I simply used dummy couplers on my car and attached them with a screw tapped into the base of the trolley car end. Another note: On prototype electric lines, couplers usually were compatible with standard railroad cars if the line interchanged traffic; on lines that did not interchange, coupler styles often varied.

Trolley pole assembly was a delicate procedure. I used a Kemtron trolley pole kit. The parts required a little filing to remove flash and rough edges, and in some cases I had to redrill holes to insure proper fitting. Also, the Delrin bushing that the stem of the trolley pole base swiveled in proved to be too long for the stem (I wanted to be able to solder a wire to the stem from the underside of the car). By simply cutting the bushing in half, the stem was exposed enough for soldering. I had to countersink a hole in the underside of the roof, however, so that I could reach the stem with the soldering iron; see fig. 19. The hook that holds the trolley pole down when not in use is simply a section of .013" brass spring wire bent into hook form and inserted through the roof. If you actually plan to use overhead power supply, there are two ways in which you can wire the trolley poles. The system I used was the standard wiring scheme whereby the car will operate off either pole but must be reversed through a reversing switch on the power pack or control panel; see fig. 20a. A second method of wiring, fig. 20b, will allow car direction to automatically be reversed when the poles are changed. Although it is necessary that the hold-down hooks be metal, it's not that much more complicated to wire it that way, but just a matter of preference.

Roof mats (they keep trolley poles from damaging the roof when being raised or lowered) and car steps are attached with a strong glue or epoxy. While you have the glue handy, you might want to attach some extra weight to your car; I glued some linotype slugs to the car floor. The slugs also helped to balance the weight of the motor. See fig. 21. There were a few more things to add, including the headlight, windows, and trolley pole retriever ropes, but these had to wait until the car was painted.

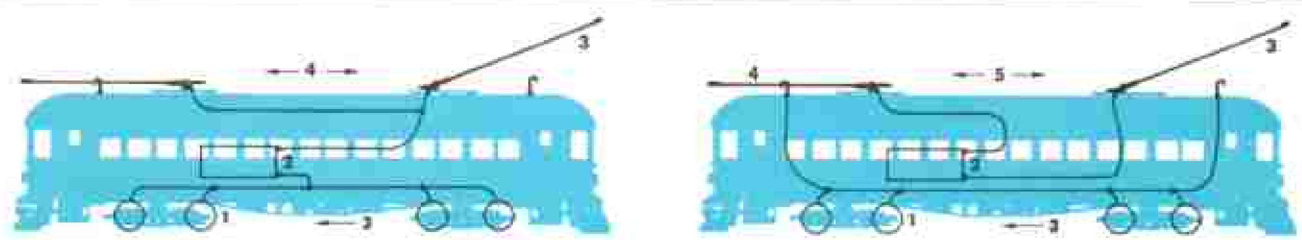
Into the paint shops

Deciding what colors to paint my car was almost as troublesome as trying to decide the design of my car before I started construction! Good old traction orange (actually Floquil's Reefer Orange) was the first color choice, but I needed a second color to complement it. I finally settled for maroon as the second color, and gold for lettering and trim. You may find it helpful to buy colored pencils and experiment with different color combinations and paint schemes.

Painting, like soldering, is something that has to be practiced to attain results that are pleasing. Basically there are four methods of model painting — brush, spray, propellant, and airbrush. Here are a few tips for each:

Brush painting. The biggest disadvantage to brush painting is that brush strokes often remain on the painted surfaces. If you must brush paint a model, use a flat, soft-haired brush for wide surfaces. Cover in smooth, quick strokes; avoid repetition of paint strokes over the same area because this is what causes brush marks to remain. Touch up those hard-to-reach places with a smaller brush. Paint should be thin enough to flow smoothly, because thick paint may cause brush marks to show up. If you are painting plastic, it is advisable to use a water-based model paint such as Floquil's "Polly S" paints. Water-based paints should not be used on metals, however. Clean the excess paint off the brushes with the appropriate thinner and wash the brush in warm soapy water. This should be done immediately after each use. Although paint may be dry to the touch just a few minutes after application, avoid handling the model for a few hours to allow the paint to cure and harden. This applies to any method of painting we discuss here.

Spray painting. Many model paint suppliers offer their colors in aerosol spray cans. Aerosol spray painting is one step better than brush painting because of the elimination of brush strokes. The greatest disadvantage of aerosol paint is that there is much waste during spraying and usually there is no control over the spray



A
1. Pickup wheels are connected to one motor lead
2. Both trolley pole bases are connected to the other motor lead
3. Reversing is accomplished through reverser switch on lines to track power
4. Motor is dead only with both poles down

B
1. Pickup wheels are connected to both hold-down hooks
2. Trolley pole bases are connected to the respective motor leads. Neither base nor motor lead can be grounded
3. Motor should be wired so positive polarity on the conductor wire will produce forward motion with rear pole up
4. Forward pole up will produce backward motion
5. Motor is dead with both poles up or down

Fig. 20

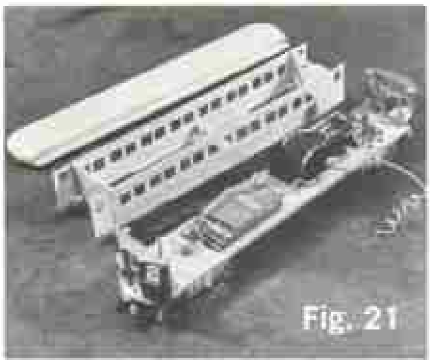


Fig. 21

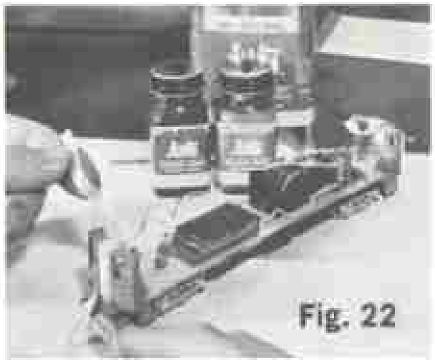


Fig. 22

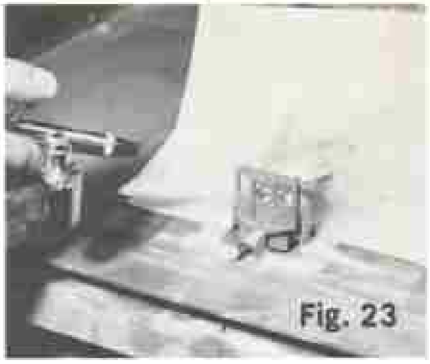


Fig. 23

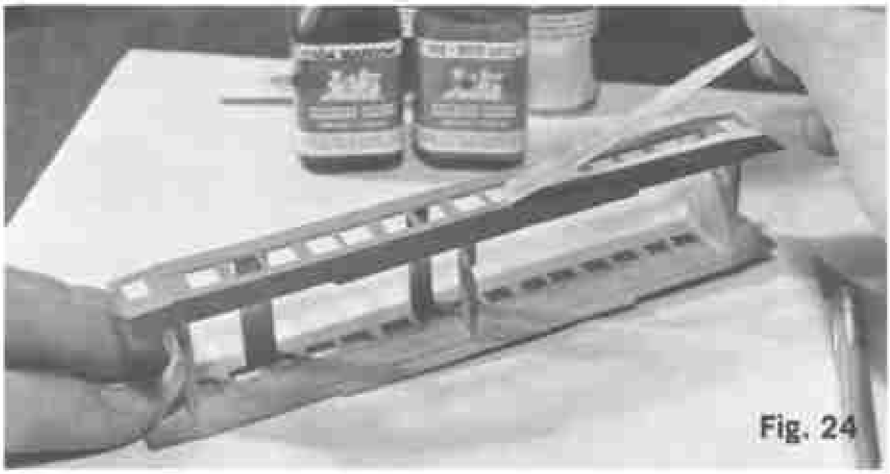


Fig. 24

mist. The tendency is for aerosol paints to expell too much paint with too much pressure. Also, spray-can nozzles may have a tendency to clog, causing paint to come out in blobs instead of a fine mist. These traits can result in a rough coating. In any event, do not let these traits scare you away from trying aerosol paints; some manufacturers have done much to improve on these points.

Spray painting with propellant may be more convenient than using individual cans of spray paint. The propellant is purchased separately, and the paint is purchased in regular bottles. Usually the paint bottles are attached directly to the propellant can or the paint is poured into special bottles made for use with the propellant. As with spray-can painting, this may be a rather expensive system if you plan to do a lot of model painting, because propellant cans are not all that cheap and don't go a long way. The disadvantages are the same as for spray-can painting.

When applying paint, use thin coats — not one heavy coat. Allow the paint to dry between coats. Spray with a sweeping motion, but don't move too fast — paint may dry in the air before it reaches the model and the coating will become gritty. Allow a finished coat to dry overnight before applying a second color.

Airbrushing. For a truly professional paint job, airbrushing is the way to go and is a skill that is easy and enjoyable to learn. We all can not afford airbrush equipment, but often two or three fellow modelers will jointly purchase an airbrush setup. A good setup will start in the neighborhood of $25 or $30.

I airbrushed my Milwaukee & Rockford car. Begin by cleaning all parts to be painted, because it is important that all surfaces be free of dirt and grease. I used warm, soapy water on the styrene sides and cleaned the metal parts with lacquer thinner. First, a layer of orange was applied to the car sides. After the orange had dried overnight, I masked off the areas of the sides that were not to be covered by the maroon layer of paint. Use regular masking tape; cellophane-type tapes will not work. Masking tape was applied with a knife edge to insure a no-leak seal; see fig. 22. I masked the car ends from the rest of the car using masking tape and sheets of paper, as in fig. 23, so paint wouldn't get on the motor.

I found that thinning the paint 1:1 worked well for the airbrush I was using. Time and practice will help you determine what paint thicknesses work best for your equipment. Adjust the paint mist so that it comes out fine and light; too heavy a spray will clog the gun. Apply paint with a sweeping motion. Sweep past the surface when you want to stop the spray; stopping the stream while it is coating the surface will cause uneven buildup. After the paint has dried, remove the masking tape by pulling almost straight back — not straight up; see fig. 24.

Because my car carried a custom road name, I lettered it with alphabet decals. For trim, I applied flashy gold striping that provided the type of "new image" look that many interurbans displayed during later years.

Follow instructions packed by the manufacturer when applying decals. You will want to use a decal setting agent to make the decals creep into every nook and cranny of the car surface. Use only the setting agent specified by the manufacturers of the decals you are using. Do not move decals around too much once you place them on the car surface. Adhesive may smear on the car sides if the decals are moved too much.

With the decaling completed, I gave my model a light coating of glaze to make the surface appear like that of freshly painted steel sheathing, and also to cover the sheen of the decals. You may want to weather your car to make it look as though it has seen many years of service. This can be done in any number of ways, from applying a light airbrush coating of a dust-like color to smearing cigarette ashes on the sides of the car. I brush-painted the roof of my interurban since prototype car roofs rarely were smooth. Interurban roofs often were covered with a tar-paper-like material, thus brush-painted gray-black made for an authentic appearance.

Finishing touches

The final step was the addition of window material. For this I used .015" clear styrene, cut into strips, and bonded to the inside surface of the car with liquid cement. Window material was attached to the metal car ends with a strong glue. Window shades were made of construction paper of a nondescript color (the kind of color found all too often in passenger car interiors!)

I used epoxy to permanently attach the car sides in place now that construction was finished. With that done, I fastened the roof into place, added the headlight and the retriever ropes, and set 'er on the tracks for a test run.

With the controller notched back, the heavy interurban car eased out of the train shed and down the street. Minutes later she was out in the countryside zinging wire at 70 per . . .

And by the way, if you don't have a layout to operate your new piece of equipment on, read on to the following chapters!

Trackwork in streets

A guide to prototype practice

BY WILLIAM J. CLOUSER

AS with most other things of our country, very few changes or improvements were planned in advance, but the demands made upon street railways forced them to progress in spite of themselves. Horse- and mule-drawn cars were light and required only the most simple rail to maintain operation. Next came cable cars. Since cable railway track required quite a bit of complicated mechanism underground between the rails, the track was sometimes made an integral part of this construction and was much more substantially built than horsecar track. Both street paving and electric streetcars became popular in the late 1880's, and the weight of the electric cars was found to be more than the previous horsecar or cable-car track could support. The paved street provided better protection to the track than old mud streets did, so each helped to protect the other.

Where the early car lines reached the edge of town, streets were sometimes nonexistent or occurred only as drawn lines on a map down at city hall. The car lines that did go into the "suburbs" usually did it for two reasons: One was to reach and provide service to a newly developed plat, with the line being promoted by the same gents who were selling lots, building homes, or operating a cemetery. The other was to reach an amusement park or picnic grounds built on the shore of a lake or at some other scenic location to attract people from the city. These combined projects were almost always owned by one group.

Around 1900 these same promoters realized the value of extending toward the next town or city, and the country trolley line suddenly emerged as the interurban. Some of the interurban promoters had big plans for their lines and visualized big electric locos hauling long trains in a form of operation similar to that of the steam roads. In such cases engineering and construction similar to steam road practice were sometimes used.

Rights of way

The year 1912 marked the beginning of the long drawn out end for electric railways. By this time most of America's interurban mileage had been built. Many more proposed miles were indicated on maps, but by this time it was quite clear that many companies were economically insecure. Even the more economically stable companies began to suffer from automotive competition on the very paved streets that the street railways originally helped to build and pay for.

The interurban lines that used steam road engineering practices in 1912 were not built as heavily as today's "steam" roads, but rather as heavily as steam roads of that day. Considering the fact that new construction was over by this time and little if anything was done to improve existing construction, it is no wonder that the once keen competition provided by the electric cars eventually fell by the wayside. The electric cars in interurban operation could run at speeds similar to steam road speeds, but they had the great advantage of providing a faster schedule because they were able to accelerate and stop in a fraction of the distance required by a steam train. Thus, in their days of success interurbans took much of the local traffic from paralleling railroad routes.

Interurban builders took the lines to the people. Many avoided buying land by building on the edges of public roads between towns. Then they went down the main street of each town, making local stops like streetcars. In operation like this the distinction between the streetcar and the interurban could be very thin. In some cases the interurban company provided separate local service in towns, using smaller cars on the same tracks as the bigger through cars. Very often interurban companies used existing street railway lines owned by other companies to reach the heart of the town or city. The track conditions were usually just about sufficient for the service provided, and some interurban rights of way looked like a simple country trolley line.

Neither interurbans nor streetcars had the weight to require heavy rail or close tie spacing. The traction motors could carry a car up a hill as steep as 10 per cent. This practically eliminated the costs of cuts or fills on economically built lines. The car trucks were always of short wheelbase so that the minimum radius could be as little as 35 feet. The versatility of these cars enabled the minimum in engineering and materials to be used in original construction and in most cases there never was any rebuilding. Few roads even ballasted their track, and those that did used the cinders from the power plant which provided their electricity.

Lines built in the towns were usually a single track down the middle of the street. If the service had to be frequent in the larger towns or cities, double track was used. Sometimes a single-track line would be built just to one side of the center of a street, providing for future double track without having to rip out the original construction. Since the early streets were either knee-deep mud in wet weather or dusty when it was dry, the track was sometimes laid right next to the sidewalk on only one side of the street, in what we today would call the curb lane. Sometimes double track was built this same way, more often than not with both tracks at the same side of the street. This kept the patrons from having to negotiate either mud or dust of the streets. In later years, the city fathers forced most car companies to comply with street ordinances and locate their track according to the laws governing other street traffic. This meant costly rebuilding — another nail in the electric lines' coffin. St. Louis, Mo., didn't pass the law requiring vehicles to drive on the right-hand side of the street until 1910. St. Louis also had a two-lane highway bridge which was over a mile long including its approaches. On this bridge, single track for the streetcars was against one railing but served both directions of travel. About 1930 the state highway department took over the maintenance of the bridge and gave the company's managers 90 days to correct this situation. They did. They abandoned the line.

One delightful practice seen in resorts and the finer parts of many cities was to place car tracks in a grass-covered parkway in the center, or sometimes at one side, of a street. This, of course, could be done only in new developments or in older ones that had sufficiently wide streets to leave room for vehicular roadways in each direction.

City and town stations were very often located in store-type buildings back of the sidewalk. The interurban might turn off the street into a shed alongside the building, or in some cases it remained on the street.

In rural areas, existing roads most often provided the routes, since these roads served not only the towns at both ends but the farms in between. Most of such lines were built on the right of way of the public road. When paving became necessary, the track ended up on the shoulder of the highway. On some narrow roads the track had to be abandoned completely.

A location beside a steam road right of way was also a common practice. This gave a real comparison of the construction methods of both. The steam roads

generally followed a straight line, and as far as grade was concerned they had generous cuts and fills. The interurban, although following the same straight line as the steam road, rose and fell with the land, since grades were no bother to self-powered cars. Another typical scene found between the rights of way of the two types of lines was the grade separation. The usual condition was that when the interurban line running parallel to a steam line found it necessary to get to the other side of the steam right of way, it would swing slightly away from the steam line, start up a grade possibly as steep as 3 or 4 per cent, swing back to cross over the steam line when sufficient altitude had been reached for a short bridge sometimes at a 90-degree angle, and then reverse the process until the two lines were parallel again at the same elevation. This condition was sometimes inverted, with the interurban descending to pass under the steam line.

Those lines which ran along the side of a steam road occasionally were built on the steam road right of way, but this was rare — as rare as was a friendly relation between the two companies. The advantage of paralleling the railroad was not only that the interurban tapped the same well-established towns, but that land paralleling the steam road was not as costly as for a separate right of way, since this way the interurban was not so likely to cross farm roads or to require buildings to be torn down or moved.

However, as the interurban approached each small town it had to veer away from the steam road to reach a village street. This was because grain elevators and other industries as well as the wide steam road station property prevented the interurban route from remaining close to the steam road.

With all of the various types of rights of way previously mentioned, it is understandable that the electric roads had no possible chance to survive once the au-

Fig. 2

tomobile became so popular. The proximity of the track and highway was alone responsible for the many accidents that literally drove some companies into bankruptcy. Grade crossing protection between a highway and an interurban line was almost unheard of in the early days, and settling accident claims helped put a few more companies out of business. The habit of the side-of-the-road interurban of swinging out into the middle of the street at high speed as it entered town was another cause of trouble.

While double track was common in the later days in larger cities, many a line in smaller cities or on the outskirts of larger places was never double-tracked. Instead, passing trackage had to be located so cars running in opposite directions could meet. Sometimes signals protected intervening sections of single track, but as often the turnouts were either within sighting distance of each other or the crews merely knew the schedules well enough to wait for an unsighted car when it was expected. Equilateral or diamond-type turnouts were used at both ends of the siding, and they usually had spring-loaded points to keep the direction of the traffic to the right. See fig. 1.

Some of the early city fathers feared that interurban roads entering their town would eventually deal in freight interchange with the steam roads, and then bring freight trains down the city streets. This brought about many ordinances on track gauge in city streets. Usually such odd track gauges were wider than the steam roads' 4'-8½". This kept the interchange freight cars off the streets but also kept the standard-gauge interurbans out of the downtown area in such cities as Cincinnati, Philadelphia, Baltimore, and St. Louis. There were some areas where dual gauge was added for interurbans, as in New Orleans, Los Angeles, and Denver, the latter two cities having a 3'-6" gauge for local streetcars, a hold-over from horsecar and cable-car days.

Some of the planning committees of the cities and towns were foresighted enough to provide for the expanding traffic of the future. In such cases the widths of the streets were far in excess of the traffic of the day so that the trolley lines were allowed to have a private right of way in the center of the street, curbed off from other traffic. The variety using a grassed parkway has already been mentioned, but in other instances the car tracks merely were on a mound of ballast in the street center. This was helpful in that the ever-increasing auto traffic did not interfere with the proper movement of the cars. Sometimes this right of way was wide enough for shrubbery or other landscaping to hide the tracks, as at Coronado, Calif. Sometimes this same type of street private right of way was located on one side of the street rather than in the middle. This was most common alongside parks, cemeteries, and shore lines, where there would be few cross streets and no buildings facing the track.

In many cities some trackage would be routed on narrow private rights of way completely separate from the streets. Quite often these rights of way were inherited from steam-dummy lines. They produced a problem each time they crossed a city street, for visibility was not good between cars and automobiles. In later days some cities installed arterial signs requiring the trolleys to

Fig. 1

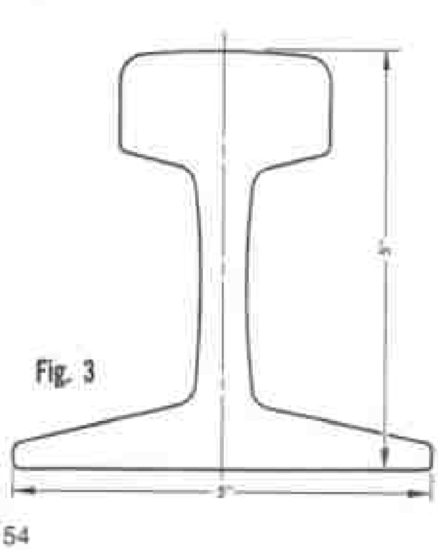


Fig. 3

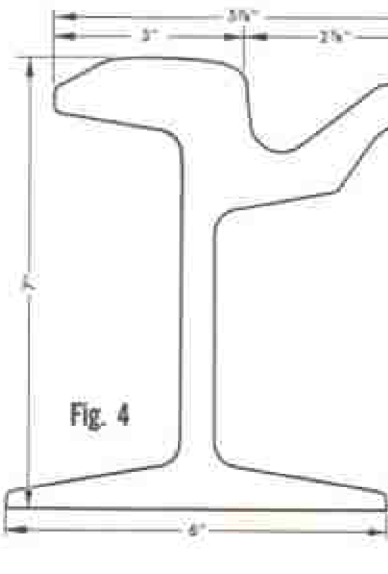


Fig. 4

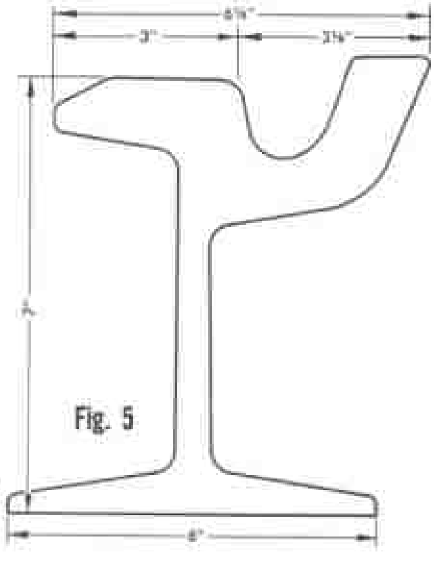


Fig. 5

stop before crossing each street — much to the discomfort of passengers sitting on the long benches.

End-of-the-line facilities for street railways were usually just as simple as the rest of their construction. Lines equipped with double-ended cars only had to stop, change trolley poles and other equipment, and proceed from whence they came. The single-ended cars often would use a loop of single track encircling one or several city blocks. This was particularly practical in the shopping district of a town or city and it also helped one car line serve a greater area. Tight loops also were common. If a city had a monument or statue located in the center of street, this was a good location for such a loop. Since the minimum radius could be about 35 feet, a small vacant lot could hold part of such a loop and the remainder could be in the street. Often a stub track was provided for disabled cars, plus a small building with toilet facilities for the crew and a telephone either in the building or on a pole. The building often was landscaped to be in keeping with the neighborhood.

Wyeing was common. The wye could lead off the street into private property, it could be entirely in the streets of an intersection, or it could be merely a junction with another line. One interurban system had all single-ended cars but provided a very clever turnback wye at almost every station. All stations were on city streets and had their freight platform on one side of the building at a 90-degree angle to the track. From the main line there was a wye leading to this freight platform. This enabled a car to pick up a trailer or to switch the wye from either direction. This also gave the line a wye for turnaround of passenger cars.

There were a few small steam railroads that saw the advantages of electrifying their operations, since they didn't have a big investment in steam locomotives. As electric lines they usually kept their turntables in service for reversing cars.

Interurban railroads that went into freight interchange on a big scale and had to get off the streets of some of the towns and cities, either because of ordinances against freight trains or because city street curves were too sharp for freight cars, built freight belt lines around the towns. These were merely private right of way routes that skirted the town and joined the original line at each end at some point where it did not run in the streets. While the freight trains ran around these belts, the passenger cars usually continued to use the town streets. In later years, when the automotive traffic became too heavy and the local streetcar service was abandoned, the interurban cars went over to the freight belts and thus were able to give faster service on long runs. In addition to using their own freight belts, some electric roads eventually were able to get trackage rights on paralleling steam roads so as to get off the streets. They would join the steam road at each side of town and also share the depot with the steam road, making it a joint agency and cutting down operating costs. Unfortunately, few interurban lines made any bypass arrangements. Some of those that did are still operating (but with diesel power).

Engineering of the right of way

Electric cars were operated either singly or in trains. Single cars meant that there was little limitation to curve radii or changes of grade. Most interurban cars were sufficiently powered to be able to start on a 5 per cent grade, and in some cases steeper grades occurred. The abruptness permitted in a change of grade was determined by car length and how flexibly the trucks were mounted. When cars were operated in trains, either as trailers behind a powered car or in m.u. (all cars powered with remote control of cars from the head-end car), the flexibility of the coupler had to be considered. If it was an MCB type with a knuckle like a steam road coupler, a severe change of grade could lift one knuckle over the other. Thus the length of the car had to be considered and the height of the knuckle had to be increased to prevent this. Most roads using knuckle couplers used the 16" high variety. Tightlock couplers designed especially for electric car use permitted more freedom, and a train could do as well as a single car. These couplers had as much vertical play as they did lateral swing and were ideal for the irregular horizontal and vertical alignments of interurban track.

Freight power pulling steam road interchange had to have knuckle couplers.

Curves limited operation in similar ways. Single or m.u. cars with Tightlock couplings could negotiate almost any curve, but longer cars, particularly interurban cars with knuckle couplers, were more limited. The general minimum curve for a city car was about a 35-foot radius, and although the bigger interurban cars could negotiate this radius singly, a minimum radius of about 45 to 50 feet was more often provided for them. Some interurban cars that ran m.u. or pulled trailers had radial couplers which could swing almost 90 degrees to either side of center.

Ties, ballast, and rail

Ties for use on a standard-gauge railway can be 8'-0", 8'-6", or 9'-0" long. Sizes listed by the American Electric Railway Association are as follows:

Size No.	Thickness (inches)	Width (inches)
0	5	5
1	6	6
2	6	7
3	6	8
4	7	8
5	7	9
6	7	10

Length of bridge and switch ties will, of course, be the same as they would be in steam road practice. Many roads used untreated ties; in fact, this was the rule rather than the exception.

Ballast (when used at all) followed about the same conditions as in steam road practice. It could be of crushed stone, gravel, or if in a coal-consuming area, cinders. Most of the "country trolley" lines laid their ties right on the ground but came back later, raised the ties slightly, and dropped cinders under and between them. In later years, most heavy interurban lines had brought their roadbed up to standards of light-service but well-kept steam railroad practice. This is particularly true of streetcar lines and interurbans that became classed in the "rapid transit" or "commuter" field. This type of operation often had better roadbed than some steam roads.

Tie plates generally were not used in interurban or street railway construction. Rail joining was the same as in steam road work with the exception of the essential rail bond, fig. 2, around each fishplate for the ground return of the electric power. This same bond would be used in steam road work for signal systems.

T rail

There were two general types of rails used in electric railway construction: ordinary T rail and girder rail. T rail is the type of rail used in steam road work, but the sizes that were used, from main line to sidings, were of somewhat lighter weights than for steam road use. Heights

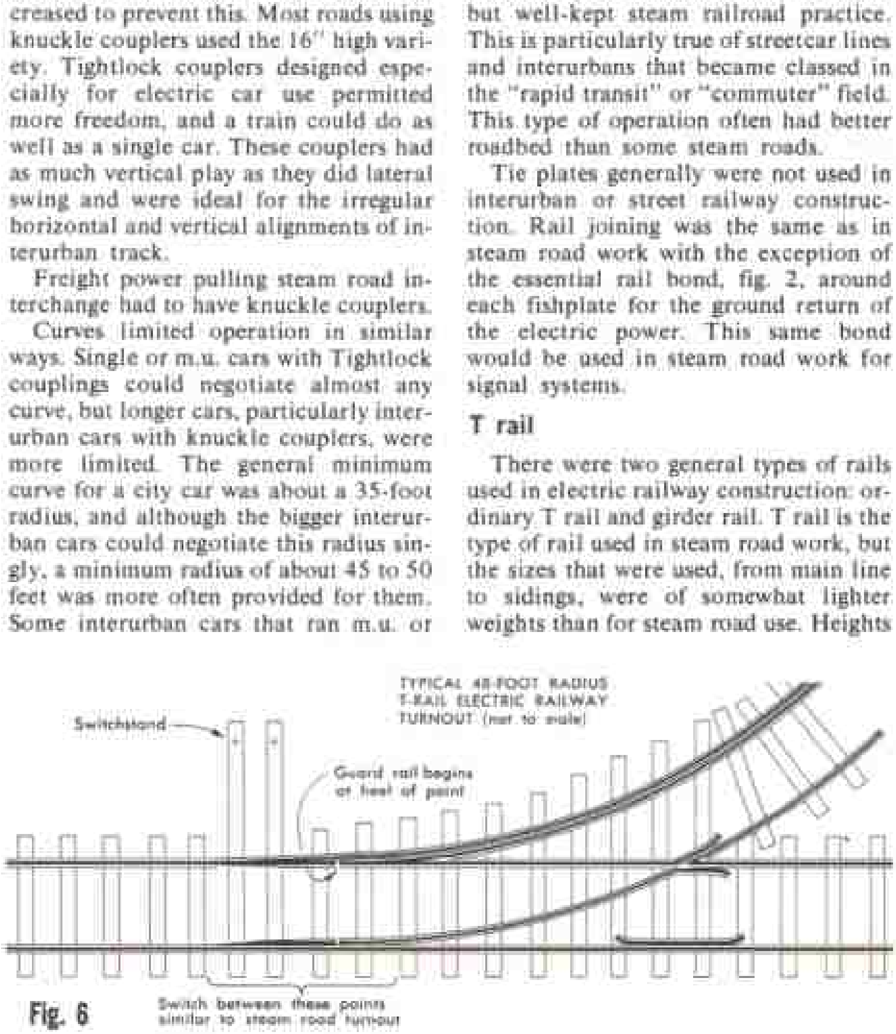


Fig. 6

T-RAIL CURVE CONSTRUCTION

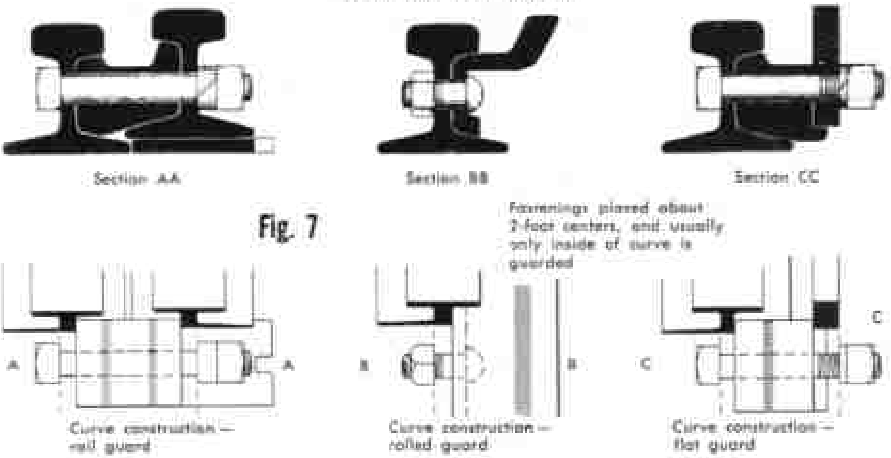


Fig. 7

of rail in inches according to their weight per yard in pounds as found in a chart in a 1918 frog and switch catalog were as follows:

Pounds per yard	Height in inches
55	4-1/16
60	4-1/4
65	4-7/16
70	4-5/8
75	4-13/16
80	5
85	5-3/16
90	5-3/8
95	5-9/16
100	5-3/4

Originally, construction of track in unpaved areas sometimes used rail as small as 40 pounds per yard. Much trackwork on little-used sidings and in car-barn areas remained in this small size down through the years. Most suburban streetcar rights of way never got above 60-pound rail even into recent times. On the other hand, some heavily traveled suburban trackage used rail as heavy as 130-pound. Interurban lines that went into heavy interchange could hardly get by with anything less than 90- or 100-pound rail. There were trends in these uses of rail but no firm rules were followed. Later car developments involved lighter weights (of cars) and better-riding trucks. This evidently appeared to be the easy way out. A typical section of 5''-high 80-pound rail is shown in fig. 3.

There was much use of T rail in paved streets in spite of its lack of a built-in flangeway protector. Sometimes a former private right of way would be lightly paved over and the railway would not bother to relay the track. There were also some heavy T-rail sections designed to be used in street paving.

Girder rail

Girder rail was of two types: girder grooved rail and girder guard rail. There were as many variations of this type of specialized street rails as there were car types. It was of many railhead sections to accommodate different wheel sections and was of many different heights for strength. The contours of the flangeways were also of many shapes.

Girder grooved rail was rail which was drawn in a section providing a protective guard for the wheel flange. This flangeway was not designed to come in contact with the flange but merely was to protect the flange of the wheel from the street paving blocks. This rail was most often 7'' or 9'' high. Fig. 4 shows the AERA section for this type of rail. This was seldom used on curves. It could be used on large-radius curves in street paving — curves that possibly would be 100- or 200-foot radius or more. It also could be used as the outside rail of a sharp curve opposite girder guard rail.

Girder guard rail looked like girder grooved rail, but on close inspection you found it had a raised flange guard that was higher than the railhead itself. This was for guiding the wheels on the extremely sharp curves used by street railways. The back side of the inner wheel flange bore against the raised rail flange on the inside rail of the curve. This kept the wheels from wandering away from the track on sharp curves. Fig. 5 shows the AERA section for this type of rail. This rail would be used on radii of approximately 100 feet or less, on both the inside and the outside rails.

Both types of girder rail were used not only within streets but also in open trackwork. Both types were made of very hard manganese steel for long wearing quality and were used on sharp curves on heavily traveled lines anywhere, to cut maintenance costs. Construction of track in streets with this rail did not involve the usual spiking-to-ties method as with T rail. Gauging this flanged-type rail on curves involved some precision in maintaining the distance between railheads, so the rails usually were joined every 4 or 5 feet with steel tie bars. These bars were threaded on both ends and the rails were carefully gauged with the adjustment of the nuts on the threaded bar ends. Sometimes this type of track was mounted on ties but more often it was temporarily shimmed and aligned with wooden blocks and then filled with wet concrete. When this set, the resulting track construction was solid for many years. Some street trackwork was done with T rail in this same way, using a specially shaped paving block (or a flangeway cast in the wet cement) to protect the wheel flange. When wood ties were used under street paving, the rails were usually fastened to them with large square-headed screws driven into the ties. There was much experimentation using steel ties, and some precast concrete ties also were used.

T-rail turnouts

When possible, turnouts were made in the same way as on steam roads, but often with lower frog numbers to accommodate sharper curves. On the whole, steam road turnouts were rare, however, because their design was not suited either to sharp radii or to burying in street pavements. On the steam road, a turnout had a frog with both rails straight. The reasons given for this were that it was easier for steam locomotives with their long rigid wheelbases to move through such a turnout frog and also that the symmetrical construction cut in half the number of kinds of frog that had to be kept in stock for repair work.

Unfortunately, space rarely permitted use of a curve with a straight section through the frog of a turnout on an electric railway. Turnouts with a curve through the frog and other trackwork of unusual design were known as "special work" in the electric railway industry. Fig. 6 shows a turnout made of T rail with a curve through the frog. If girder rail was not used, provision had to be made for a guard rail along the entire inner rail of the curve in this type of turnout. Fig. 7 shows cross sections through three such bolt-on guard rail methods.

The height of the guard rail over the running rail sometimes was altered because of the type of wheel used by a particular company. If the wheel had a flange less than 1'' in depth, the guard rail was raised about 7/16'' over the head of the running rail. See fig. 7. If the wheels had 1'' flanges, the guard rail was then made level with the running rail. Bolt-on guard rails also were used generally where T rail made a sharp curve.

Switch throws for T-rail turnouts

Standard parts from steam railroading also were used for switchstands when possible. Again, as before, many of the types contemporary to the day when the roads were built lasted to the end. Switchstands out on the main lines gen-

PLAIN GROUND THROW SWITCHSTAND
(All steel — weighted lever)

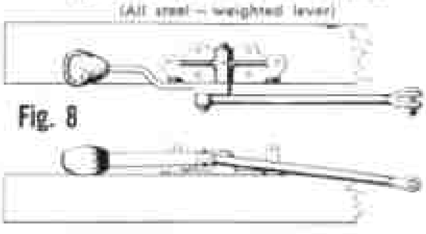


Fig. 8

erally had high switch lamps, just like the steam roads. Some tapped power from the pole and so had electric lamps instead of oil. In yard areas some of the simple industrial throws were used, as no indicating lamp or target of any type was needed. See fig. 8.

T-rail turnouts in streets where the company wanted to maintain the usual switchstand had a long throw rod reaching from the turnout to the side of the road where the switchstand was located. The throw rod was protected from auto traffic by placing it between two timbers flush with the road surface, with some sort of metal or plank cover.

Spring switches were very popular, as they could easily keep the flow of traffic going to the right at sidings and crossovers. They also were used at the end of double track, at loops, and at wyes at the end of the line. The spring switch usually had a standard switchstand but with the throw rod connecting to the points with a spring. It allowed a trailing movement to snap through the spring-loaded points with the points returning to the original position. A turnout so equipped would be spring-loaded to favor either branch route, depending on the position the switchstand had been set for.

On roads where long trains were run, there was a lot of wear in the sprung T-rail turnouts of this type, since each wheel set pushed the points over and let them snap back again. This pressure between point and wheel created much friction. To reduce wear, a dashpot or some other type of slow-release air cylinder was added to momentarily hold the points in reversed position so that the pressure was reduced. On many lines, any spring switch had a letter S painted on the switchstand target or had some other warning that it was a spring switch. This was important so that a car stopping over the turnout would be warned not to back up and have wheels go down both branches.

Cast manganese switches and switch mates

Girder types of rail were used for long wear and better efficiency in paved streets, and they also made a smoother roadway for wagons and automobiles. Turnouts to match girder rail also were made. They usually were of a single-point type, almost always having the point on the inside rail of the curve. These single points were referred to in all trade manuals as "switches," fig. 9, and the tongueless points opposite were called "switch mates," fig. 10. The mates had no moving parts. These also were sometimes known as "tongue-and-groove switches."

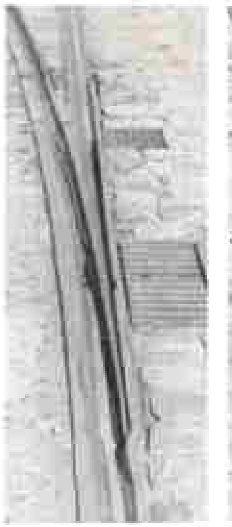


Fig. 9

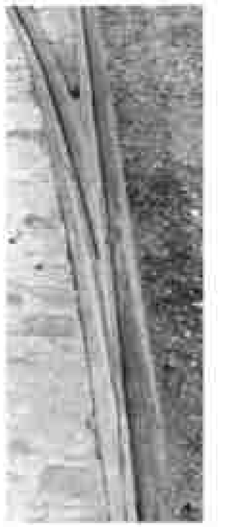


Fig. 10

Basic standards for such switches were set by the AERA, but since many widths of tires and many depths of flanges were used, almost all switches were specialized to meet the needs of a particular company. Most large cities had enough street railway business to support their own "frog and switch" company. A few of these companies dealt nationally.

The switches and switch mates also could be made entirely of T-rail materials as shown in fig. 11, or they could be T rail with manganese inserts as in fig. 12. They could also be complete castings as shown in fig. 13. These assemblies extended from just 1 foot or so ahead of the point, or tongue, as it was more commonly called, to about 1 foot beyond the pivot point at the heel of the tongue. From this point on toward the frog, the curve could be of any radius, or it could be a spiral.

If a switch and its mate were designed for straight track with a diverging route either right or left, the assembly would be classified as a "lateral-tongue" switch. If the switch and switch mate were for an installation where both routes diverged (modelers now call this a wye switch), and if the branches to the right and left had equal radii, the assembly was called an "equilateral-tongue" switch. One or both sides of the tongue usually were curved as required for the design. In this respect the design was also quite different from steam road practices. The dimensions for the length of the tongue or point and the radius of the curve at the switch according to the AERA was as follows:

LATERAL TYPE
Point or tongue length — which had a radius of:

	Inner rail	Track Center
5'-1"	47'-7½"	50'
6'-1"	72'-7½"	75'
6'-11"	97'-7"	100'
9'-4"	197'-7"	200'

EQUILATERAL TYPE
Point or tongue length — which had a radius of:

	Inner rail	Track Center
5'-1"	97'-7½"	100'
6'-11"	197'-7½"	200'
9'-4"	347'-7½"	350'

The above radii were for the switch casting only. These determined the angles at which the cars left the tangent. The curves beyond the point assemblies generally were spiraled and could be of any suitable radii, even as low as 35 feet.

The tongue in this type of switch was supported for its entire length by the base of the main switch casting. This allowed it to be aligned easily by the wheels in trailing movements. In fact, this type of turnout never had to be prealigned by hand or power for trailing movements, only for facing movements. In the early days of this type of switch, the tongue was held in position by a rubber block. To align the switch for the other direction, this block had to be removed, the tongue moved, and the block replaced to hold it in the reversed position. Later the block was eliminated and a spring toggle-action assembly was built into a cast box on the side of the main switch casting.

Fig. 14 shows this mechanism, and fig. 9 shows it on the side of the casting. This was a mechanical assembly whereby the single spring held the tongue in one position until the tongue was forced to

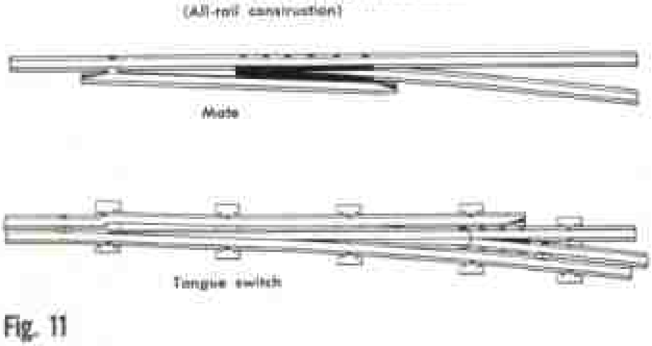


Fig. 11

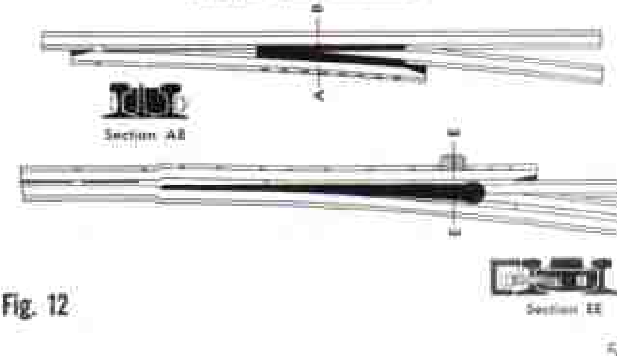


Fig. 12

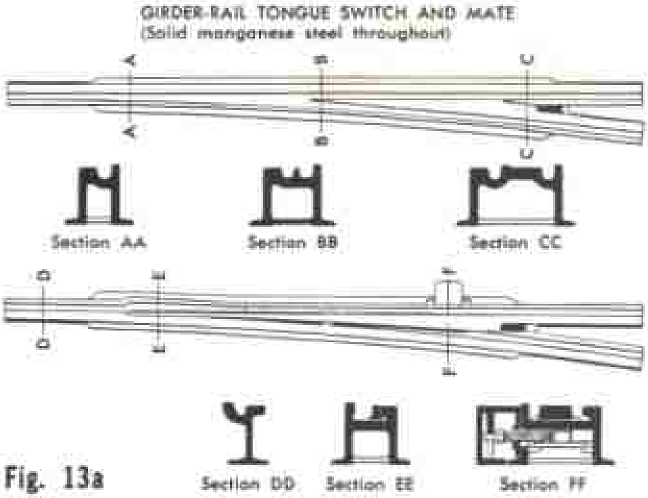


Fig. 13a

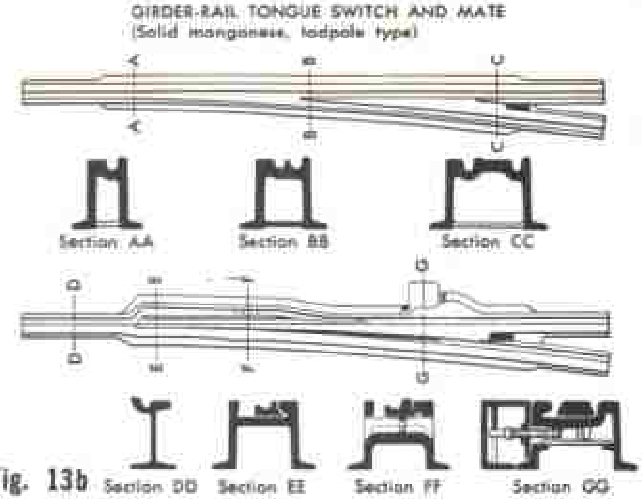


Fig. 13b

Fig. 14

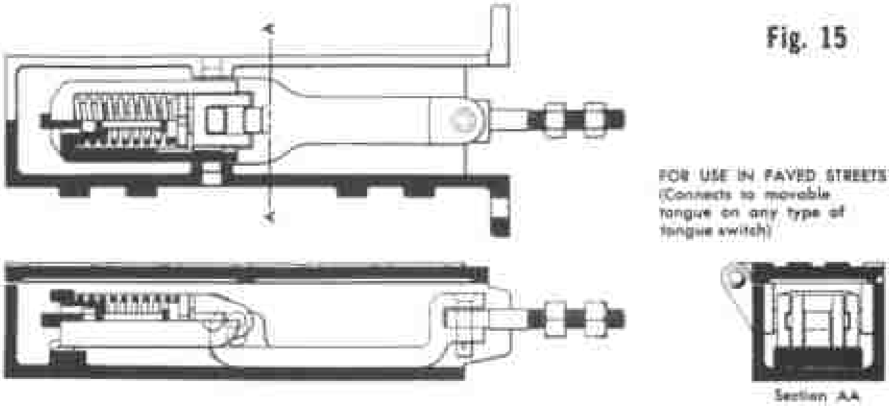


Fig. 15

the center of its travel over dead center and then it snapped to the other position. This worked both ways. This type of turnout with attached box was also used for ordinary spring switches. The toggle-action spring then was removed in favor of one that would hold the point at one side.

Another version of the cast street switch spring arrangement was one where the control of it was from a box with a lid flush with the street paving. Since no switchstand was available to reset a spring switch in street paving, some railways had a chain attached to the mechanism so that this box could be opened, the chain could be pulled and held by the conductor or a crewmember other than the motorman, and the car could proceed in a direction opposite the normal spring setting. When the chain was released, the switch tongue went back to its normal sprung position. Fig. 15 shows a flush-mounted operating device for throwing switches in streets.

All interurban and street railway cars carried a switch iron or switch bar. This was a long bar used to pry the tongue of a cast-type switch to the opposite position. Switch irons varied in length; some companies had them long enough that the motorman could pry the switch from the front window without having to get out of the car.

Since there was very frequent service on some city lines and track junctions where different lines diverged, a system more convenient and faster than the switch iron was needed to speed up the operation of changing facing-point switches. This was accomplished by powering the switches with motors or solenoid coils. On the usual system the position of the switch was determined by whether the power of the car was on or shut off at the moment when the trolley pole passed under a trolley contactor on the wire. The switch motor was enclosed in a box in the street, attached to the switch casting and covered with a lid

Fig. 16

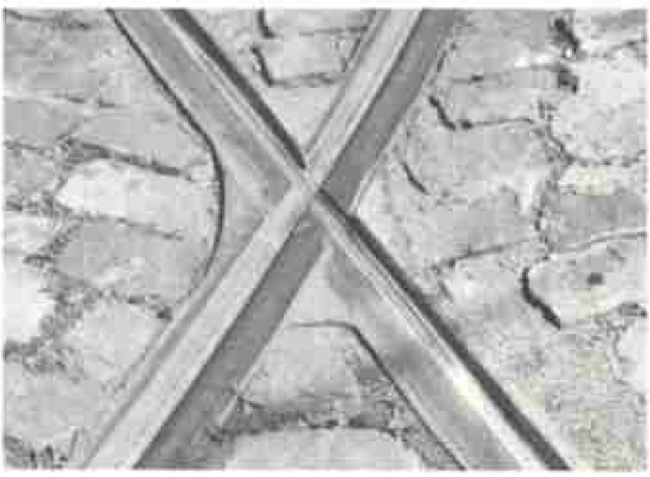


Fig. 17

flush with the street paving. See fig. 16.

A slightly simpler arrangement of the powered switch was sometimes used at car barns, at turn-in points, and in some cities at places where traffic on the branch was not so dense. Any car going under the contactor would line the switch for the main line, but a motorman choosing to use the diverging route would have to pass under the contactor, stop the car, and then manually change the switch position.

Frogs and other crossings

If the entire turnout assembly was "out of the catalog" of a switch company, there were stock castings for the frogs that matched the given curve to be used. This cast frog was also of limited length, being only several feet long on both track members. See fig. 17. To fabricate a complete turnout required the switch and switch mate castings, the frog castings and the necessary girder rail and tie bars to join these components, plus the girder rail to complete the curve. In addition to a limited number of frog castings that were stocked for use in turnouts, there were also 90-degree crossing castings. These castings, comprising just one intersecting rail crossing, made up the entire crossing for all rails when used in groups of four. See fig. 18.

All frogs, crossings, switches, and switch mates usually were built to be "flange-bearing." This meant that although the bottoms of the flangeways normally were deep enough to clear the wheel flanges, the bottom of the flangeway was ramped up to a higher level in the crossing assembly, switch, or frog. Thus the wheel would be supported on its flange at the point where it crossed any other rail. At these places the tire was raised off the rail. This practice created a smoother ride and less noise, but more important, it eliminated the pounding and wear the square corners of the casting would otherwise have taken. Figs. 10, 17, and 18A show this by the worn line in the bottom of the flangeway.

Special work

This was a big term in street railway work. When the track for a big street intersection or sometimes just for one diverging track was planned, all of the girder rail, switches, switch mates, frogs, and crossings used came under the term special work. The connections between routes, the separation to insure vehicle clearances between one track and another, or to a curb or building, were carefully planned on the drawing board. For instance, in addition to the necessary track at a crossing of one route with another, most railways would add several curves and switches to allow for irregular movements of equipment. They usually would also provide at least enough switches and curves so that there would be wyeing possibilities to be used for turning back in case of emergencies.

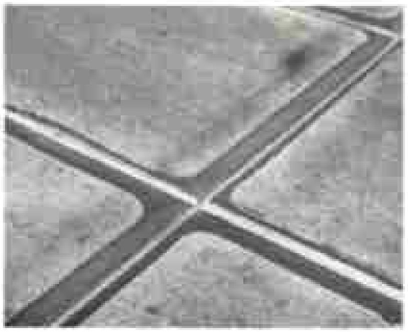


Fig. 18a

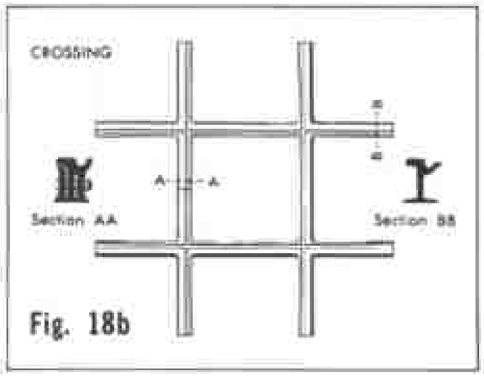


Fig. 18b

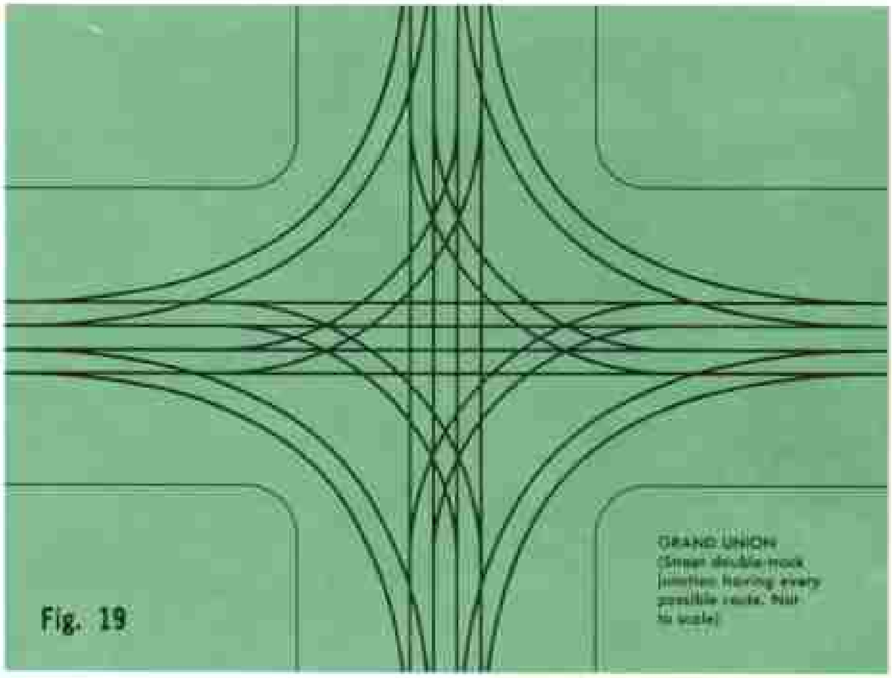


Fig. 19

Fig. 20

This entire trackwork assembly would be made by a frog and switch company using precurved girder or T rail, specially cast frogs and crossings, and sometimes special switches (if stock switches were not suitable). The special work would be checked for gauge and operation at the firm's assembly shed; the parts would be numbered and then would be disassembled and shipped to the railway for reassembly at the site. Most of these installations were gauged with rods between the rails and then set in wet cement. Street surface paving, of course, varied, and it will be discussed subsequently.

Fig. 19 shows the "Grand Union" — the epitome of special work. Such arrangements used 16 switch sets and 80 crossing frogs. (In the illustration some sets of three frogs are shown coinciding as one. This was not always the case.) "Grand Unions" were rare in later days, but old photos reveal that at one time many large cities had one or more.

An interurban or street railway track

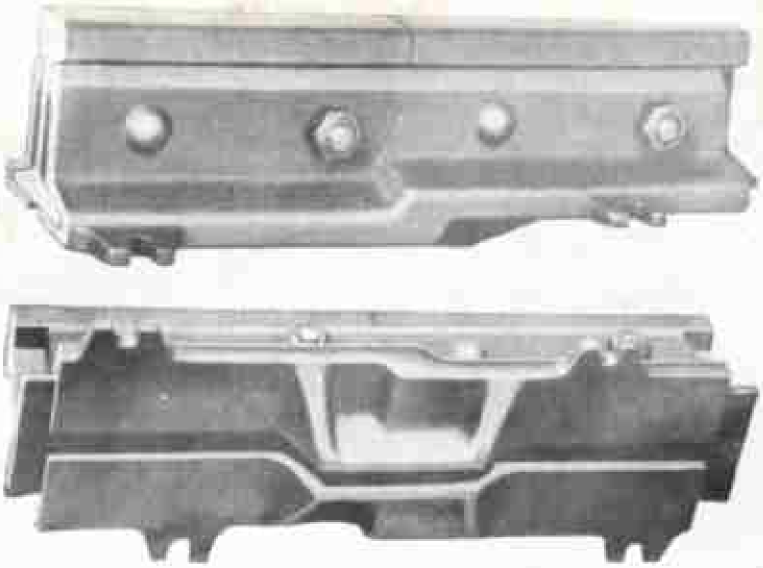


Fig. 21

crew did not always use complete cast frogs. If a new track was to be cut into a tangent, the crew very often welded the precurved girder rail to the sides of the tangent rail at the normal frog position and then cut a flangeway through the tangent rail with a cutting torch and grinding wheel. See fig. 20. The whole assembly was aligned and the rails were polished for smooth operation with a portable grinding wheel.

As abandonments were effected, parts of the track at complicated intersections often were left in place. In some cities very few, if any, parts were removed. Finally when only one route remained through a complicated intersection of special work, the tongues of all facing switches were welded in the one needed position. The frogs and crossings had the flangeways filled so as to make a smooth path for the wheels and lessen the chances for derailments. Portions of unused track usually were paved with asphalt right to the edge of rail still in service.

Compromise joints

With the many types of rail used, compromise rail joiners were plentiful. These had opposite ends formed so as to join rail of two different shapes or sizes. Fig. 21 shows a catalog illustration of one. Fig. 22 shows the simple flair or chamfering used on the corners of girder guard rail to prevent fouling the wheel flange where joining with other types of rail. Fig. 23 shows a T-rail compromise joint in use.

For many years electric railways were large users of continuous welded rail in street construction. The rails were welded on location. Soft-metal Babitt cast joints also were popular.

Many, if not the majority, of street railway franchises required the company to maintain the street pavement between the rails and for a short distance to each side. If the line was double-tracked, the "6-foot way," or space between the tracks (not always 6 feet wide) also was included in the requirement. This made sense in horsecar days. The electric lines inherited the requirement. Later it became a point of complaint when wear and tear was due not so much to the now-horseless railway operation as it was to automotive traffic.

In some cities the legislators also required the railway company to pay in part for the entire street paving and to plow snow beyond the track route confines. These requirements helped speed the abandonment of street railways and resulted in the company's taking little interest in removing rail after abandonment. Many a car line still rests reasonably intact below modern pavements. In one instance during a pipe-burying project in Milwaukee, Wis., three layers of former street railway ties, the uppermost still holding rail, were uncovered in an intersection.

One of the problems with paving was the provision of a flangeway, once streets were paved at all. Early pavings were made of cobblestone, brick, wood blocks, and sometimes larger stone pieces. Macadam paving also was used, but concrete and various asphalt pavings became more popular when automobiles shared the streets with the trolleys. Early stone roads sometimes produced broken wheel flanges due to stones projecting

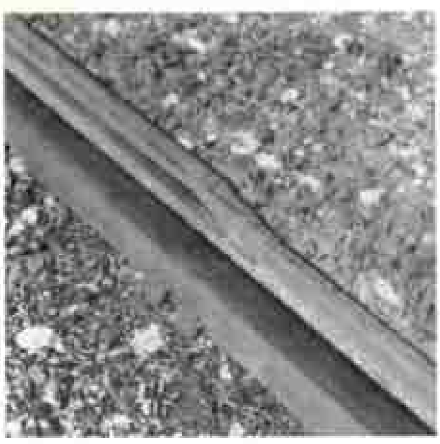


Fig. 22a

Fig. 22b

Fig. 23

Fig. 24

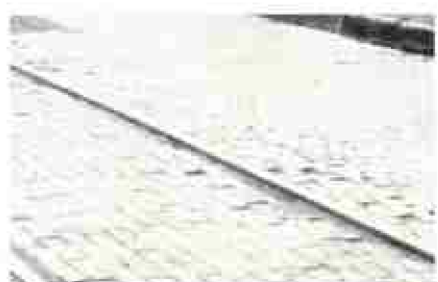


Fig. 25

into the flangeway. In time, paving companies offered specially contoured stone blocks and bricks that fitted the rail side and provided a wide flangeway as shown in fig. 24. Brick paving, fig. 25, was used in areas where brick was cheap. The length of the bricks paralleled the track in some cities but the bricks were laid crosswise in others.

Ties and spikes eventually were forsaken in favor of girder rail laid in concrete, and with this construction the concrete itself helped give the track strength. The girder rail eliminated most of the possibility of wheel flange chipping.

In some cities the concrete was laid only up to the underside of the railhead and the surface was brought up to grade with asphalt. See fig. 26. These same practices with girder rail also were done with T rail to which a guard rail had been bolted. Some T rail on ties in private right of way in the center of the street was later lightly paved over with gravel and oil. This did not last long, nor was it durable as can be seen in fig. 27. For durability, girder rail was used in open track, especially in loops or on sharp curves. See fig. 28. Since the railway companies usually were responsible only for the area containing their tracks, many combinations of paving from curb to curb could exist. Today the routes of former car lines often can be traced by noting the patterns of cracks in the street, the result of different kinds of street paving in the lower layers now covered over.

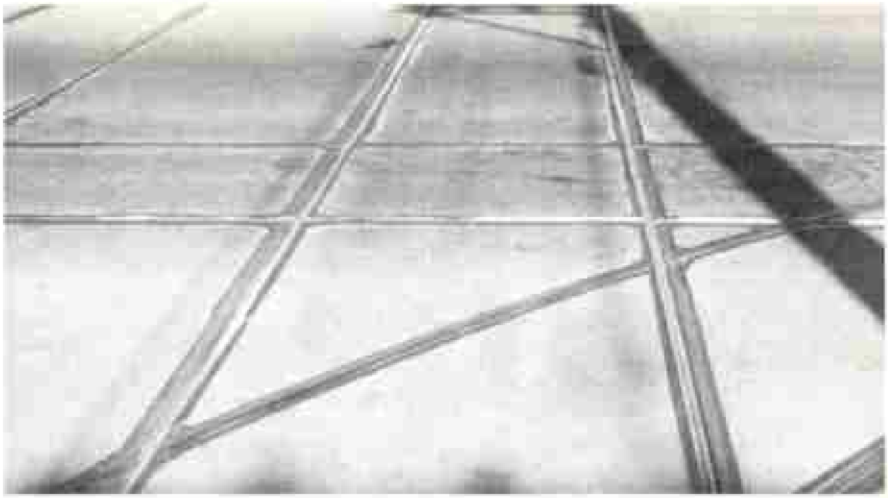


Fig. 26

Fig. 27

Fig. 28

Wheel details

Street railways didn't have the need for heavy cars as did steam roads, nor were there any intentions of interchange, so they developed tire widths and flange depths according to their own needs. One thing that happened in the early days was that the rail became depressed into the paving by the cars and the outside of the wheels became chipped. Because of this, many railways used wheels that had tires no wider than the narrowest railhead width in use, 2" or 3". While steam roads use tires about 4½" wide, street railways used tires sometimes as narrow as 2½". Thus, if the rail depressed, the pavement would not harm the edges of the tires.

With the slow speeds and light equipment, the flange depth did not have to be very great either. Steam roads use about a 1" flange. Street railway flanges were as small as ½" but varied all the way up to steam road standards. Interurban lines using heavy cars at high speeds generally used larger flanges but used the narrow tire because of street operation in towns. Interurban roads that interchanged with steam roads used steam road wheel standards, by necessity.

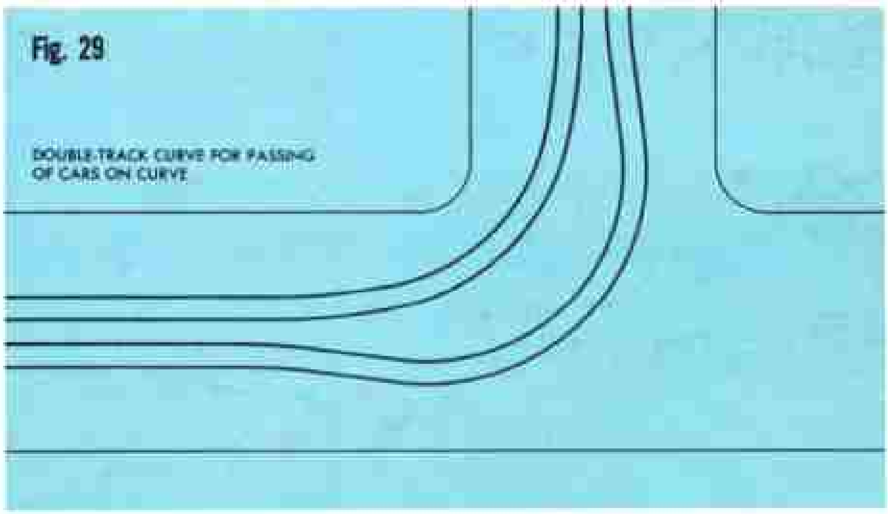
Curves and overhang

Street railway cars were designed to operate on curves down to a 35-foot radius and had to be as flexible as their design could allow in order to operate in narrow streets.

A serious problem was the matter of clearances between cars on double-track lines at curves. Many a situation required one car to wait for the car coming the other way to avoid sideswiping. However, by careful location of the pivot points of the trucks and by spiraling at least the inner track curve to spread the tracks farther apart, many companies found it possible to allow cars going in each direction to turn at the same time. Another practice, where the inner track could not be spiraled enough, was to have the outer track make a little reverse turn so that it could use a larger radius at the intersection. Both practices were then usually combined as in fig. 29.

The truck centers of such cars normally were at an equal distance from the ends and the crosswise centerline of the

Fig. 29



car so that on a sharp curve the overhang would be about equal on the outside and the inside from the middle of the car. The exact geometric location for equal overhang depends on radius, but is a little closer to the ends than to the center. On longer streetcars, where the trucks had to be closer to the ends anyway, the ends of the car body generally were tapered to allow for the extra overhang. Interurban cars that had couplers for m.u. or trailer service had to have their trucks near the ends. Thus, nearly all of the overhang would be at the middle of the car.

Besides allowing for clearances in track locating, company-owned buildings and poles had to be positioned to avoid fouling the cars on curves. The type of curve illustrated in fig. 29, and already mentioned, required much room. A similar problem had to be solved when a branch line turned into a side street. Where a minimum clearance was used between tracks, the swing of the rear of the car leaving on this branch would foul any car coming on the other track of the straight main line. This was avoided by installing the switch and having about 15 feet of tangent rail at a slight angle from the main before starting the curve. See fig. 30. This allowed the car to swing gradually away from the opposite track before making its turn and avoided the danger of a car's rear end projecting into the path of the other track.

In streets the paths of overhang generally were marked with painted white or yellow lines to warn motorists to stay clear of turning cars. The motormen also watched carefully and reduced but never eliminated overhang accidents. Track in street railway work generally was spiraled on curves the same as it was on steam roads.

Fig. 31 shows a typical junction between a single- and double-track route. The arrangement provides a trailing-point crossover for the main line as well as access from the branch to either main track.

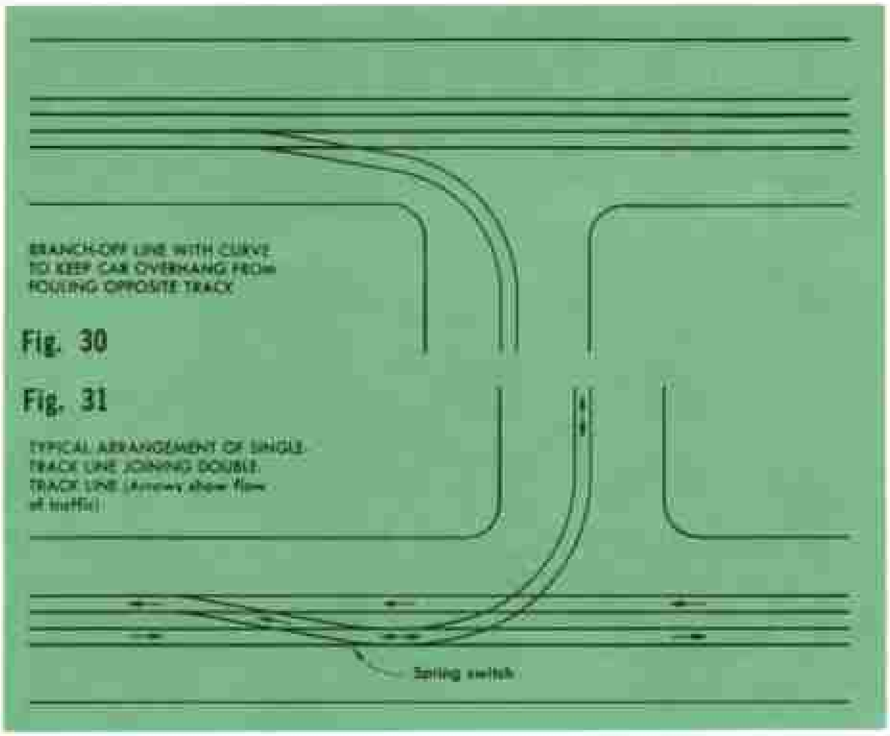


Fig. 30

Fig. 31

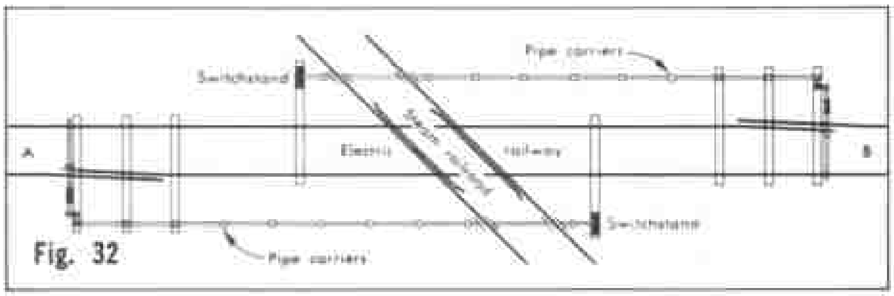


Fig. 32

Crossing of steam and electric railway

Interurbans out in open areas often crossed steam roads on equal terms, using signal protection. Some lesser roads had to stop and flag at a steam road crossing. Another method was to install a normally open derail. The switchstand to align this derail so that the car could pass was on the opposite side of the steam track, and the second member of the crew had to cross the track and hold the derail in position until the car passed. This setup was installed in both directions, but the opposite derail operated as a spring switch and did not interfere with the passing of the car. See fig. 32.

In streets the cars used the same gates or crossing watchmen as did automobile traffic. Since the crossing of steam road tracks by electric railways was never generally accepted by the steam roads, a double-track line often was brought to single track at each side of the crossing. This arrangement would use spring switches.

Since the flangeway of most street railways was not deep, the crossing was usually built so that the steam road's rails were not cut. The rails of the electric line would join those of the steam line and only the minimum of flangeway would be notched in the steam road's rails. Fig. 33 shows three crossings in progressively heavier degrees of use on one route.

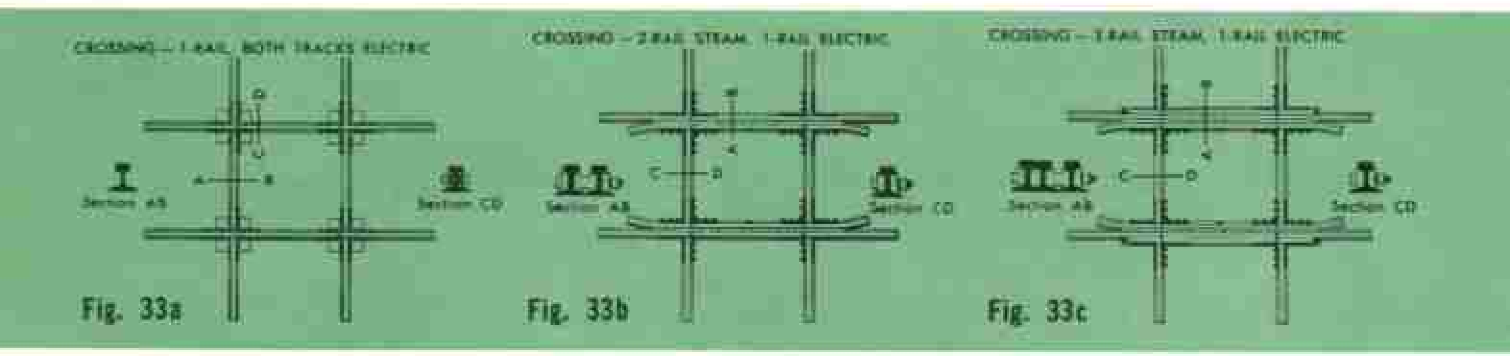
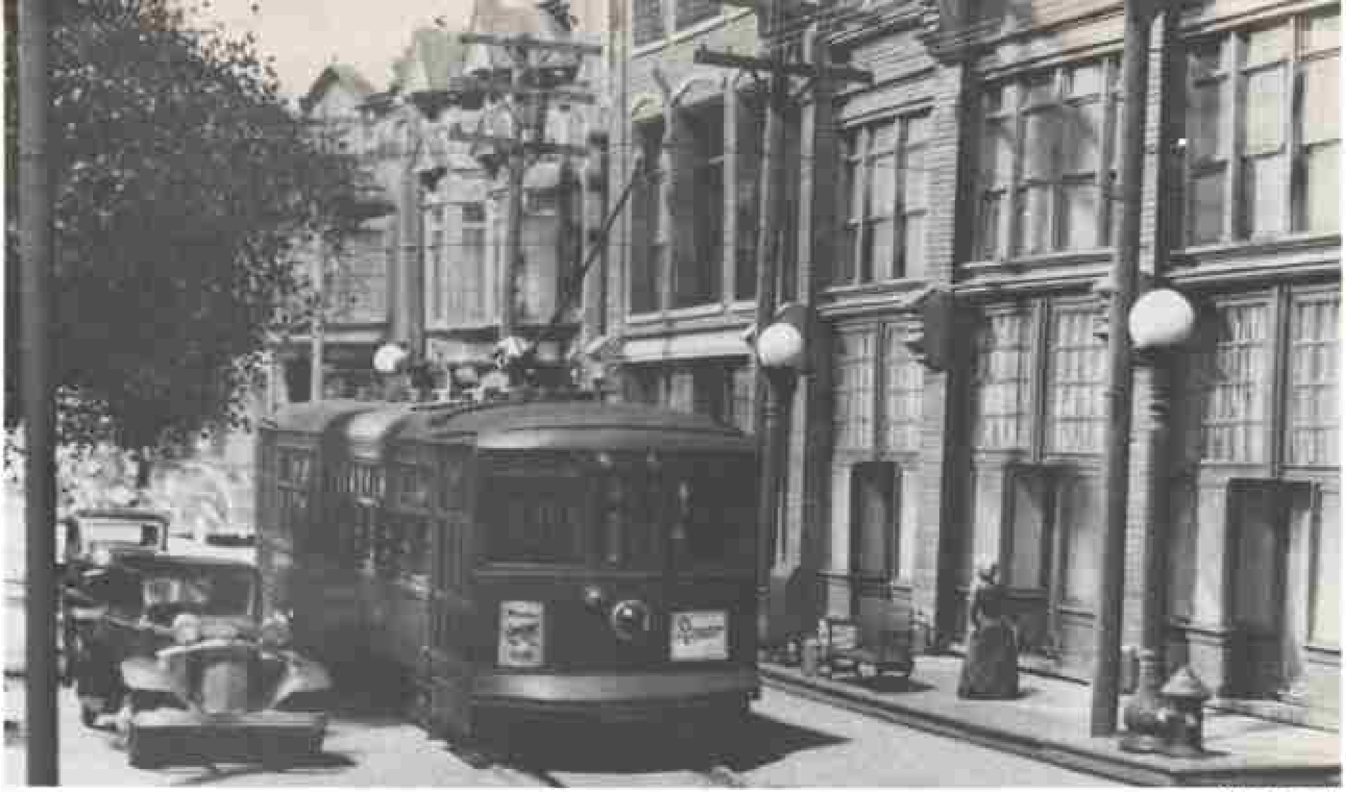


Fig. 33a

Fig. 33b

Fig. 33c



Mike O'Connell

A trolley trundles through the crowded city streets of Charisma in this ¼"-scale diorama built by Mike O'Connell of Glendale, Calif.

Modeling street trackage

Most prototype traction cars invaded city streets to get downtown. Let your models do the same!

BY JOHN T. DERR

STREET trackage, when modeled carefully, can be impressive. If you have a special fascination for streetcar railways, you probably will discover that modeling street trackage can be particularly enjoyable; but even if your layout is patterned after interurban railroads, where trains operated on open trackage similar in construction to that of steam railroads, you will find that street trackage still can be an important addition to your layout. Unless interurban lines maintained a private right of way through town (most uncommon), most of them reached their downtown terminals via trackage laid in paved city streets.*

Planning and preparation

Ready to start that job of laying street trackage? Let's do some planning first. If your street trackwork will be all-new construction, omit ties and ballast and spike your rail direct to the material you will be using for the street base. Plywood is a natural for basing, but keep in mind that it acts as a sounding board and can be noisy (although the paving materials may deaden some of the rumble). Also, plywood is brutal for spiking unless you are fortunate in getting a soft-grained piece. Another choice is Homasote board, available at most lumberyards. Homasote is a good sound deadener and it is easier to spike into than wood, although more spikes are required.

If you're going to have any diverging routes lead into unpaved right of way of regular tie-and-ballast construction, shim the rails in the adjacent street area with cardboard sheets to avoid sharp changes in elevation where track swings onto ballastwork; see fig. 1. The open trolley trackwork on my O-gauge line has ties that are made from .2"-wide by 1/16"-thick stripwood. For shims that match the thickness of the ballast and ties, the gray cardboard that comes with tablets of paper or with shirts is just about right. Transition from shim to ballastwork should not be too abrupt; if necessary, feather the shim edges with coarse sandpaper to the correct thickness.

Before actual tracklaying and paving begins, the width of the paved area should be determined. Each lane for vehicular traffic is usually about 12 feet wide, thus the minimum paved width of a street — allowing 8 feet for a single trolley track in the center — would be about 32 scale feet. For double track, add another 10 scale feet or so. These widths apply to streets that might be found in an older section of town. To include a parking lane clear of the two traffic lanes and their tracks, add another 8 scale feet on each side.

Also determine street width in relation to the total layout area, especially with smaller layouts. The width can be reduced considerably in areas where the roadway is not close to the viewer, is parallel to the viewer, or is near eyelevel; this creates an illusion of depth in the layout.

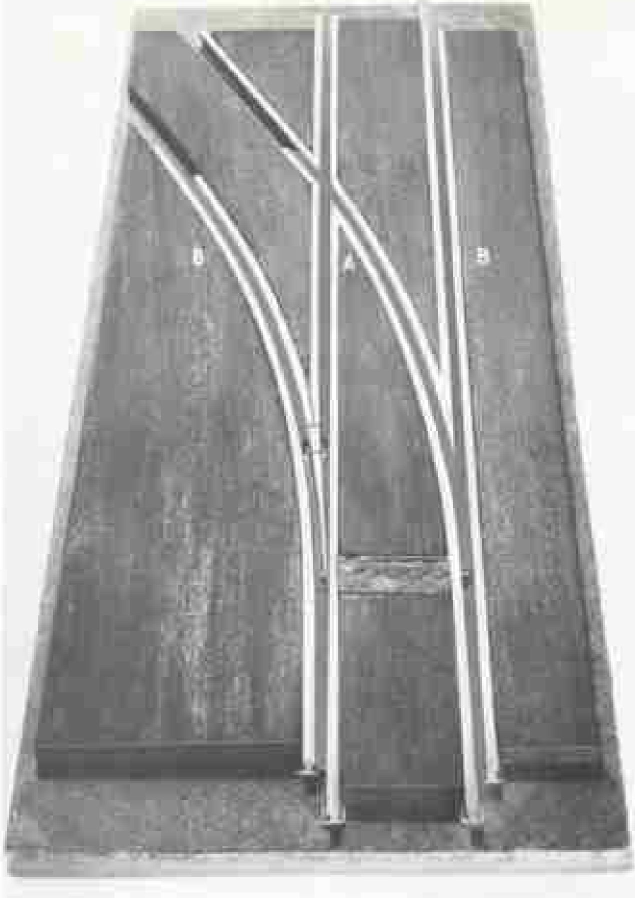
Methods of tracklaying

As noted in a previous chapter about prototype practice, the use of girder rail in paved streets was almost universal. For modeling, however, only one source of ready-made girder rail is available, and that is ¼" fine-scale stock made by

*Some of the exceptions to this were such third-rail interurbans as the Chicago Aurora & Elgin, the Laurel Line (between Scranton and Wilkes-Barre, Pa.), and the Philadelphia & Western (now part of SEPTA, the Southeastern Pennsylvania Transportation Authority).

John T. Breuer

Fig. 1 (above). Cardboard shimming will alleviate abrupt changes in rail elevation where trackage goes from street to private right of way. Rail bases have been painted gray prior to paving. Fig. 2 (right) shows how guardrail simulates girder rail in a switch.



Clyde L. Gerald.

William J. Clouser of St. Louis, Mo. It is excellent material to use if you are advanced in ¼"-scale traction modeling; but unless you are following critical fine-scale standards for your track and equipment, consider the following methods for girder-rail simulation.

The first procedure involves the use of full *guard*rails in place of girder rails (but only in switches and sharp curves), similar to steam-road construction. Because trolley-car wheels are guided through switches by the flangeways in the paving, only one of the switchpoints has to be movable. Thus, virtually all trolley switchwork is of single-point construction; this makes guardrails on trolley switchwork more important than those on standard two-point switches found on steam railroads.

To duplicate the prototype girder rail used in paved switchwork, the inner guardrails must be continuous throughout the switch area. See fig. 2. Starting approximately 4 scale feet in front of the points, the guardrails are laid parallel to the running rails right up to the point where they meet at the frog (A in fig. 2). The guardrails on the outer rails of the two turnout legs (B in fig. 2) continue at least to the line with the guardrails of the frog or beyond. The inner guardrail can be carried clear around the curve if the curve is of sharp radius.

The problem with this type of guardrail construction is that two rail bases laid side by side usually result in a flangeway that is too narrow. The remedy is to use modelmaker's lill pins or even straight pins as spacers. Cut the pins to a usable length of about ⅜" to .5" (12 mm. or so). The heads are large enough to hold down the rails, yet the bodies are slim enough to act as spacers. See fig. 3. Of course, regular spikes should be used on the outside rail bases. Use an NMRA track gauge to keep the gauge and the flangeway from becoming too tight. On curves, however, we usually have to cheat a little by widening the gauge a mite — the standards on the NMRA track gauge were designed for railroad curves, not the sharp variety encountered on a trolley line through our town. Recommended minimum radius for trolley curves is a scale 36 feet, although I certainly would suggest that you spread it out to 48 feet if at all possible.

For milder curves and tangent sections of street trackage, we again can take exception to the rule of universal use of girder rail in paved street areas by just using standard rail. Even the Red Arrow Lines (now the Red Arrow Division of SEPTA) did so a few years ago for a rail-renewing project on the Sharon Hill streetcar line. Girder rail was not available, so standard rail was used throughout, with wooden forms placed in the flangeways during paving operations and removed after the paving had cured. Even then, only an ardent trolley buff would notice the difference in the finished street!

Another method of girder rail simulation that we'll touch on briefly is one used primarily by O-gauge traction modelers: a section of rail is placed on its side, with its head against the web of the running rail. Solder is flowed in a continuous bead between the rails, joining them into a unit. In this way, the upright base of the rail simulates the guard portion of a girder rail; see fig. 4. Whether or not you use this method may depend on the gauge you model and the code size of the rail.

There is one problem encountered with this method. With the present tendency to conform to scale railhead sizes on small model rails, I have found that this often results in a flangeway that is far overwidth and too shallow. If you have power trucks and car wheels with anything above .05" flanges, this method is not for you. Even with .05" flanges, you will find that the wheels ride on the tips of the flanges instead of the treads.

If you try this method, experiment with different combinations of rail sizes. Only short sections of rail should be soldered at a time, to allow the excess heat to dissipate. Use a knife-edge file to remove excess solder and to clean out the bottom of the flangeway. When laying curved track, and prior to soldering, prebend the inner rail to match the ra-

dius of the running rail to avoid kinking.

Since the width of these flangeways may be wider than NMRA standards, use your track gauge only for laying straight track. For curves, spike down and complete the inner running rail and its guardrail, but adjust the gauge of the outer rail to suit a long-wheelbase trolley truck, preferably one with 7-foot centers.

As you work on your tracklaying, continue to check track gauge carefully and make sure your trackwork is as perfect as you can make it. Any alterations after paving will be just as hard to do as it would be for the prototype, short of using jackhammers!

The paving operation

Trackage all finished? Let's call in Union Paving. There are several materials available for paving. Three primary ones are sheet wood, embossed plastic or cardboard, and plaster.

Thin wood (or cardboard) has long been a popular choice for paving. Some modelers use sheet balsa successfully. It is readily available at your local hobby dealer and is easily trimmed to fit rails around curves. For code 125 rail (the size generally used by O-gauge traction modelers), use 3/32"-thick sheets of wood. Keep in mind that sheet material will end up slightly thicker by the time several coats of paint and a coat of sanding sealer are applied. HO'ers with code 70 rail should try 1/16"-thick stock. Heavy cardboards with a kraft paper surface, used as a protective packing material for finished wall panels, also can be used. Matte board for picture framing is an excellent paving item since it comes in a variety of colors, some of which are very close to concrete road colors.

To install wood or cardboard sheeting, first fit it to the outside edge of the rail and then trim to form the edge of the road. After this, bevel the underside corner of the rail edge of the sheet with a sandpaper block to clear the rail base and the spikes; see fig 4. Fitting the sections between the rails is the hardest part of paving with cardboard or sheetwood. Flangeways must be parallel and have adequate wheel clearance, yet they must not be too wide for appearance. If you are laying a blacktop road, paint all street sections with a flat dark gray paint before gluing them down. Using a small brush, also paint the inside of the rail with black or dark gray paint. This camouflages spikes and any rough work and gives the flangeway a finished look; but remember to wipe the running surface of the rail before the paint dries. When all is dry, glue the road sections into place with a white glue such as Elmer's. Don't be too liberal with it in case you may want to make some track changes in the future. Fig. 5 shows a cross section of street trackage paved with cardboard and masonite.

Brick streets, once so popular in the cities, can be duplicated with embossed cardboard or plastic brick sheeting. See fig. 6. This material is on the market in all gauges. Brick material is realistic and simple to apply with straight sections of track, but it does not work well on curves, where bricks should appear radially to match the rails. It is better to change to an asphalt surface on the corners.

The third choice of material for paving is plaster. Patching plaster or plaster of paris can be used. Mix according to instructions on the package. Experiment with different brands and types of plaster to find the one that best suits your work requirements. Beware of certain plaster substitutes, especially those that are mixed with epoxy hardeners. Once dry, they actually may be harder than concrete and be impossible to work with!

Mix only small batches of plaster until you get the "feel" of it and the speed at which it sets. This is particularly true if you are simulating brick the hard way — by scribing the mortar joints. Place a few tacks around in the paving area, with the heads below what the finished surface level will be. These will give the plaster something to hang on to and prevent flaking when it dries. Dump a pool of plaster on your street and smooth it out using a small trowel, a wide-blade putty knife, or a wooden block. Keep that surface just below the rails ever so little. Clean out the flangeways for adequate clearance, depthwise especially. This is extremely important because too shallow a depth will cause grief later on. Roll a spare set of wheels over the rails as a final check to see that flanges do not touch the plaster at any point.

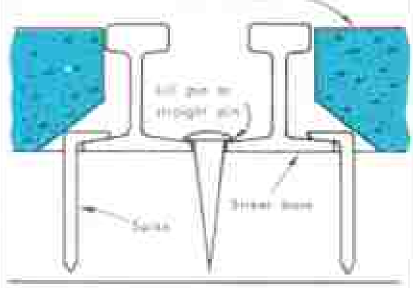


Fig. 3

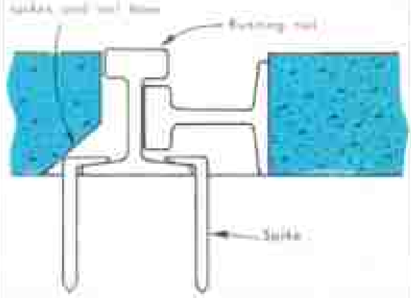
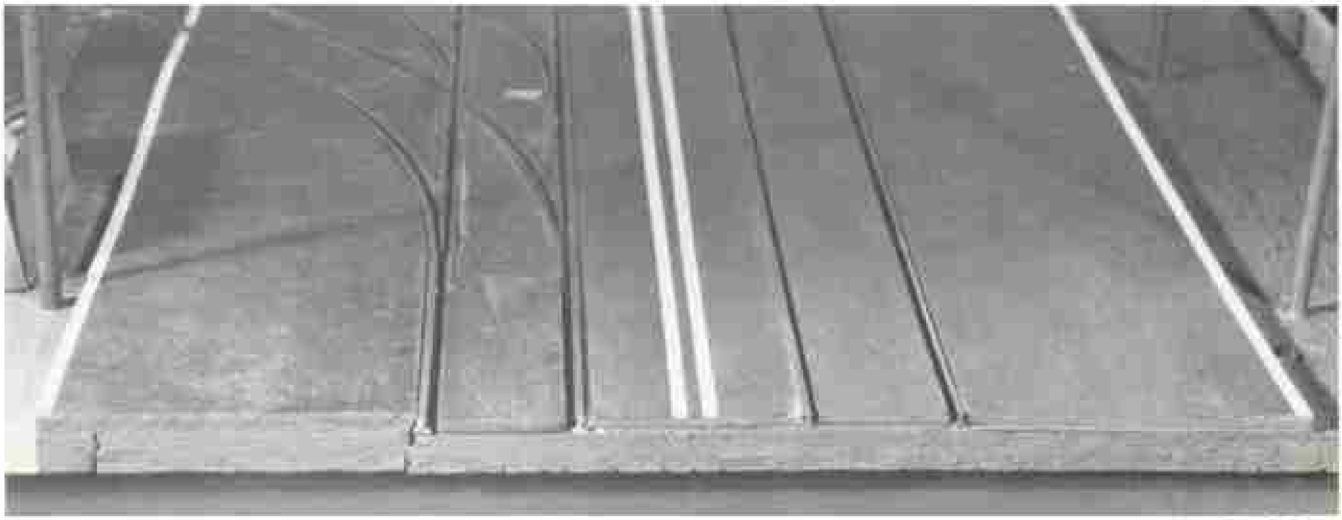


Fig. 4 SIMULATED GIRDER RAIL



John T. Breuer

Fig. 5. Cross section shows two methods of paving with pre-cut sections of road surface. Left side of street utilizes code 156 rail and 1/8"-thick Masonite. Right side is code 125 rail spiked to thin layer of card, with thicker card used for paving.

John T. Breuer.

Fig. 6. A combination of plaster and embossed brick material was used to make this realistic section of abandoned street trackage.

At this point I'll mention a procedure that will alleviate the job of clearing out flangeways from freshly poured plaster and will give a neater appearance to the finished street trackwork. Use small, thin brass angle stock placed parallel to the running rail to simulate girder rail. The angle stock acts as a small dike to keep plaster from touching the face of the running rail, and looks like authentic girder rail. See fig. 7.

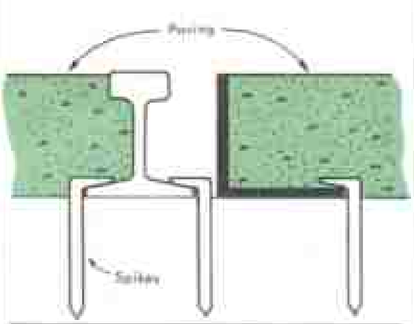


Fig. 7

Use a brass angle that is slightly smaller than the height of the rail you are using. When spiking it parallel to the running rail, again make sure there is enough clearance for the wheel flanges. On curves, you may have to split the *base* of the angle at a number of points so that it can be formed into curves; see fig. 8 and fig. 9.

Many modelers prefer to scribe their own brick surface. Some scribe or score the mortar joints just before the plaster dries hard. To do this, use a sharp-pointed scriber or pencil and make the bricks all the same size, keeping the joint spacing to your proper scale. When finished, brush off any plaster dust and check for imperfections. Again, make sure plaster is not fouling flangeways.

Other modelers prefer to wait until the plaster has initially hardened — perhaps 24 hours — before scribing the brick joints. This work period cannot go beyond approximately 48 hours though, because the surface will chip or flake off when worked too dry. As a final step, brush on a thin coat of shellac for a sealer, covering all the plaster including that in the flangeways (if you did not use the brass-angle method). WARNING: Do not omit this coat of shellac. Plaster dust will wear out your gears and bearings like crazy. When dry, paint to suit the street surface you are modeling — brick, blacktop, or concrete. For a realistic brick color, try a red oxide primer. The color is close and dries dead flat.

So, the track has been laid through our town, and the streets are paved and ready for traffic. All we need is overhead wire, but that's another chapter.

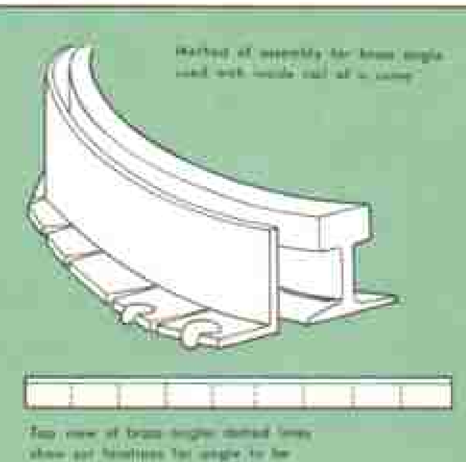


Fig. 8

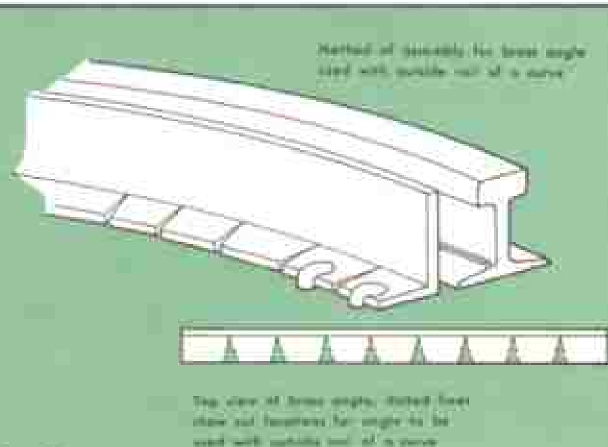


Fig. 9

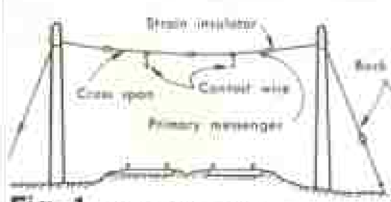


Fig. 1 SIMPLE CROSS SPAN

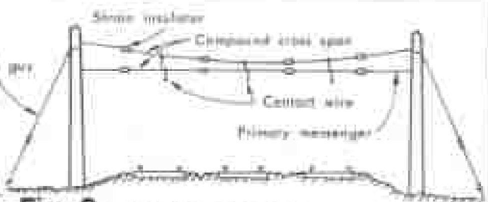


Fig. 2 COMPOUND CROSS SPAN

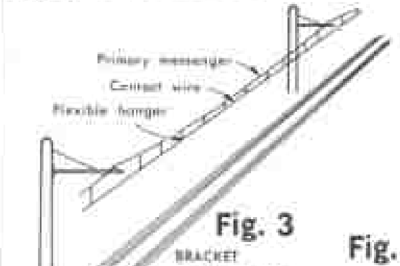


Fig. 3 BRACKET CONSTRUCTION

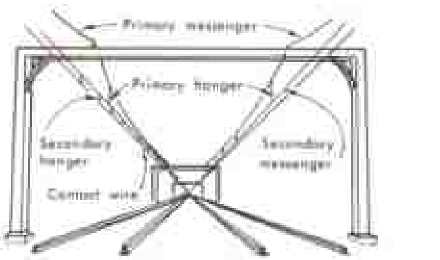


Fig. 4 BRIDGE CONSTRUCTION Compound catenary suspension

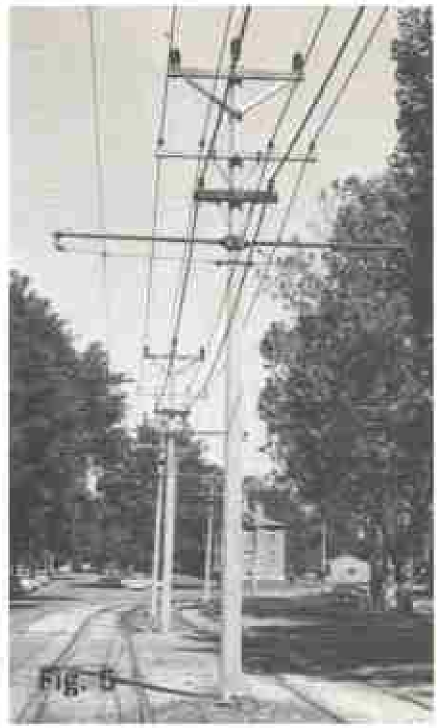


Fig. 5

Traction overhead

A guide to prototype practice: Part 2

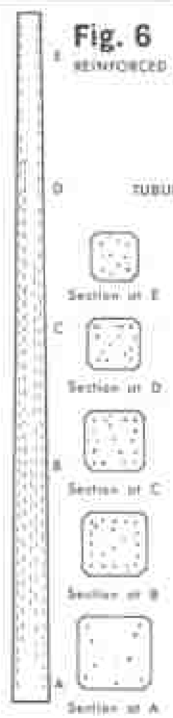


Fig. 6 REINFORCED CONCRETE POLES

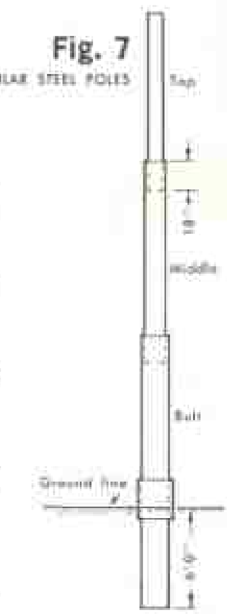


Fig. 7 TUBULAR STEEL POLES

BY WILLIAM J. CLOUSER

MANY types of direct suspension and catenary construction were used around the country, and it was sometimes possible to recognize railroads by the appearance of their main lines. This article describes the more common types of trolley pole and pantograph methods of collection. The direct suspension section covers only 600-volt D.C. transmission, since other types were rare and their construction was somewhat different. Many of the terms and phrases and also the names of parts varied from year to year, because they were different according to their locations around the country.

The references used in compiling this article were the *Engineering Manuals* of the American Electric Railway Association, as revised to December 31, 1929; the *Electric Railway Journal*; catalogs of the Ohio Brass Company; and information from railroad men formerly employed in overhead construction and maintenance.

This chapter covers overhead typical of traction railroads, other than electrified portions of steam railroads. The overhead construction can be classified in two ways: direct suspension and catenary suspension.

Direct suspension comprises all systems of trolley construction in which the contact wires are attached directly to the main supporting system.

Supporting systems

Supporting systems for direct or catenary suspensions are as follows:

Simple spans comprise all the suspension systems having at each point of support a single flexible member, such as a wire, which is attached at both sides of the track or tracks as in fig. 1.

Compound spans are all the suspension systems having at each point of support two or more flexible members, such as wires, which are attached at both sides of the track or tracks, with the upper member of this span carrying part or all of the vertical load of the lower member. See fig. 2.

Bracket supports are suspension systems having at each point of support an arm or similar rigid member, attached only at one side of the track or tracks. These arms can be of angle, pipe, T section, or similar metal structural section. See fig. 3.

Bridge support. This is the supporting system having at each point of support a rigid member attached at both sides of the track or tracks. These are sometimes I beams or laced girders. Refer to fig. 4. ("Bridge" refers to the horizontal member supporting the wire and has no connection with the term "bridge" as a track construction spanning some obstacle.)

Supporting structures

Wood poles. AERA requirements for poles listed three types: chestnut, eastern white cedar, and western red cedar. The general size requirements are that a 40-foot pole should have a 9" dia. top and 15" dia. butt. A wood pole approximately 40 feet long should have about 6 feet in the ground. Pole length is determined by the conditions in which the pole will be used.

A pole 75 feet long would have approximately the same top diameter but would have a butt about 24" dia. A pole of this length was used, for example, where an electric railroad passes under a highway or another railroad, but all the feeder wires were elevated on taller poles to pass over the obstacle with the necessary clearance.

All wood poles should be "roofed" at a 45-degree angle at the top parallel to the wire or else have a "coned" top for drainage.

Concrete poles, fig. 5, sometimes were

Fig. 8

Fig. 9

Fig. 10

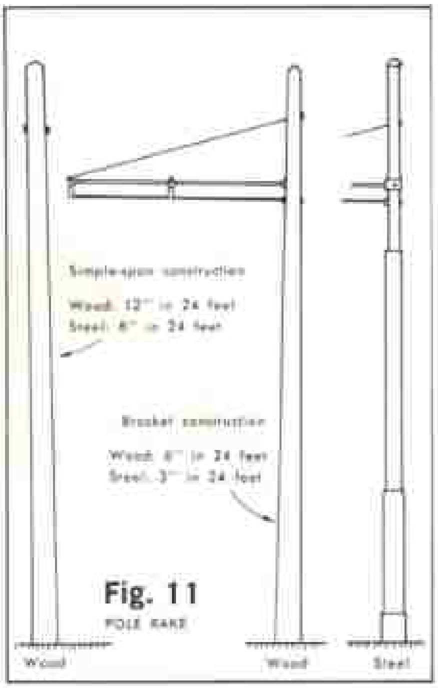


Fig. 11
POLE RAKE

Fig. 12

used for durability and long life. These were of many sizes and shapes and usually were precast at the shops, with steel reinforcing rods or cables cast in, as shown in fig. 6.

Steel poles were of many types and were used where maintenance was difficult or for long life. The most common was the tubular variety, fig. 7, but there were also uses of I beams and H sections, as well as laced steel, as shown in fig. 8.

Bridge construction. Supporting bridges occasionally were of wood pole construction with some form of rigid connecting horizontal member to support the overhead. Bridge construction was more commonly of all steel. In the early days of this expensive type of support, the bridges were of laced steel; in later years they were of H or I sections. Some roads had bridges of concrete poles with steel horizontal members, an example of which is shown in fig. 9.

Usually, bridges were used to support wire over more than one track. Bridges also were used more commonly in catenary rather than direct contact systems because of the tremendous loads of catenary construction. Bridge construction that would support these heavy catenary loads also could be spaced farther apart than other forms of support. A form of a bridge support occasionally was used on elevated sections of track such as deck and through girder bridges. These generally were of light sections of steel structural members to lighten the load carried by the track bridge as shown in fig. 10.

Towers. Some electric railways were owned by power companies. The railway's right of way was used for the power transmission towers and the towers also supported one or both sides of the overhead.

Buildings. In shop areas or where trackage ran adjacent to buildings, the wire often was supported by the building walls which had embedded rings or eyelets for attaching the span wires. Inside buildings, the wire was suspended from the ceiling with a type of construction to be explained later.

Miscellaneous. Whenever the track was in a confined area or between any type of permanent walls, these generally were utilized to save the cost of poles or other means of support. In truss bridges, the bridge structure was used. In tunnels, the ceiling or span support from the tunnel walls was used.

Pole setting details

Clearances. On private right of way and wherever else practicable, poles or side supporting structures should be set with a minimum clearance of 7 feet from center line of track to the side support. This clearance is to be increased if necessary for rail superelevation or for car overhang on curves. On streets, poles were behind the curb line unless local ordinances prescribed another location.

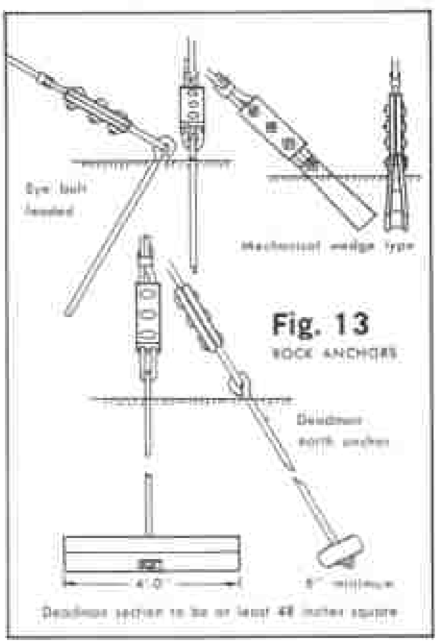


Fig. 13
ROCK ANCHORS

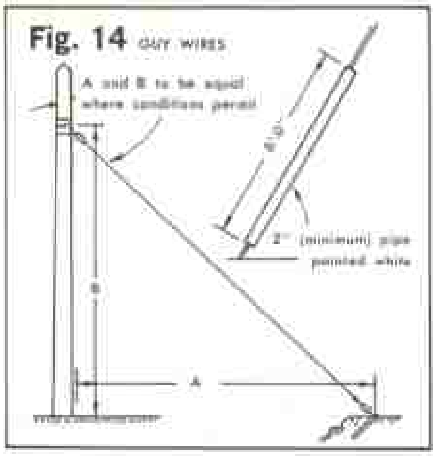


Fig. 14 GUY WIRES

Pole spacing. Poles on tangents normally should be spaced not less than 90 feet nor more than 110 feet apart. Poles on curves should be set as near as practicable to the following table:

Radius of curve (ft.)	Pole spacing (ft.)
40	35
50	40
60	45
70	50
80	55
90	60
100	65
125	70
150	75
200 to 500	80
750 and over	100

Pole rake (angle of pole in ground, fig. 11). Wood poles with brackets should have, in general, a rake from the track of 6" in 24 feet. Steel poles with brackets should have a rake of 3" in 24 feet. Wood poles with span construction should have a rake of 12" in 24 feet, and steel poles with span construction should have a rake of 6" in 24 feet. When the strain is from the track, as with poles on the inside of a curve, brace poles or head guys should be used and standard rake maintained. Double bracket poles should be set without rake. Other poles between track, and poles under outside jurisdiction may also be set without rake, if necessary. Pole rake is shown in fig. 12.

Guys and anchors

Anchors are defined as a suitable point of fastening a guy wire to the ground for the purpose of bracing a pole to counteract the load of the overhead wire, such as on the outside of curves in track construction. A common type of anchor was the wood "dead man" buried in the ground. It was usually a section of a wood pole at least 4 feet long and 6" in diameter buried not less than 4 feet in the ground. It had a rod attached which ran up to ground level and had a loop in it for attaching the guy wire. This rod had to be in line with the pull to be applied to it. See fig. 13.

There were other types of commercial anchors on the market. An adjoining pole also could be used as an anchor, providing the guy wire was attached not less than 7 feet from the ground. This was for the protection of people or animals who might run into it if it were lower.

Guys are of seven-strand steel wire, and they should be set so that they will be at a 45-degree angle or less. Guy wires are protected by a white-painted steel pipe at least 6 feet long when located where they could be a hazard to animals or people. See fig. 14.

Guy hooks are at the level of the guy attachment on the pole to prevent the guy from sliding down the pole or damaging it. See fig. 15.

When it is impossible to attach a guy to an anchor, a "high guy" can be run from pole to pole at a continuous height until it can be run to the ground to an anchor as in fig. 16. Fig. 16 also shows some of the required clearances for guy wires, and the positioning of insulators.

Crossarms. The lowest feeder, telephone, or signal crossarm should have its center not less than 21 feet above the top of the rail; other feeder, telephone, or signal crossarms should be spaced at least on 24" centers. If the pole also carries a transmission line, there should be a clear distance of at least 6 feet between the top crossarm and the lowest transmission arm. Refer to fig. 17.

Crossarm bracing. Arms 36" long should have braces 20" long fastened to the arm 12" from center; arms more

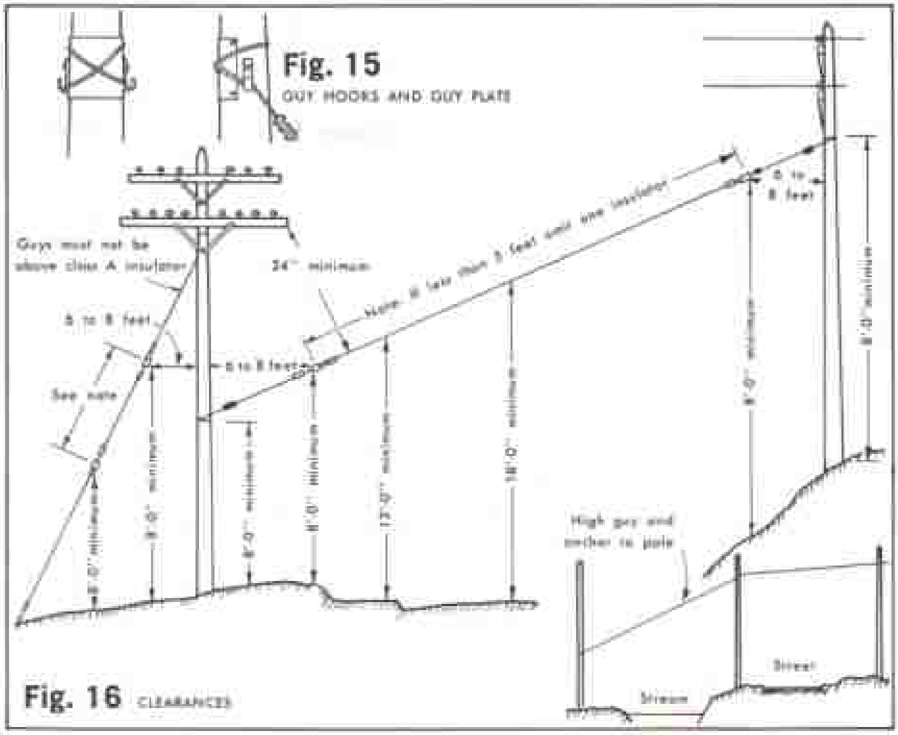


Fig. 15 GUY HOOKS AND GUY PLATE

Fig. 16 CLEARANCES

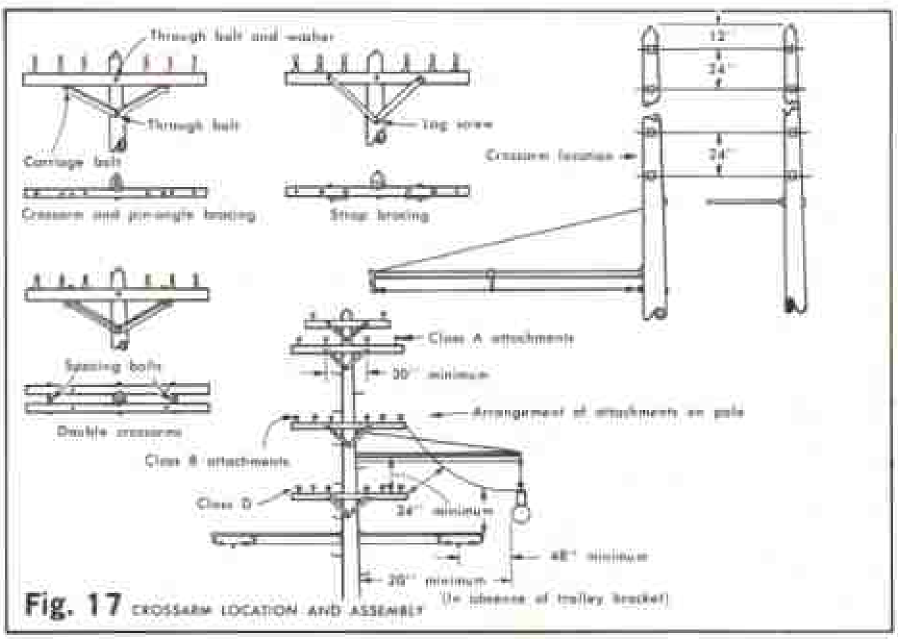


Fig. 17 CROSSARM LOCATION AND ASSEMBLY

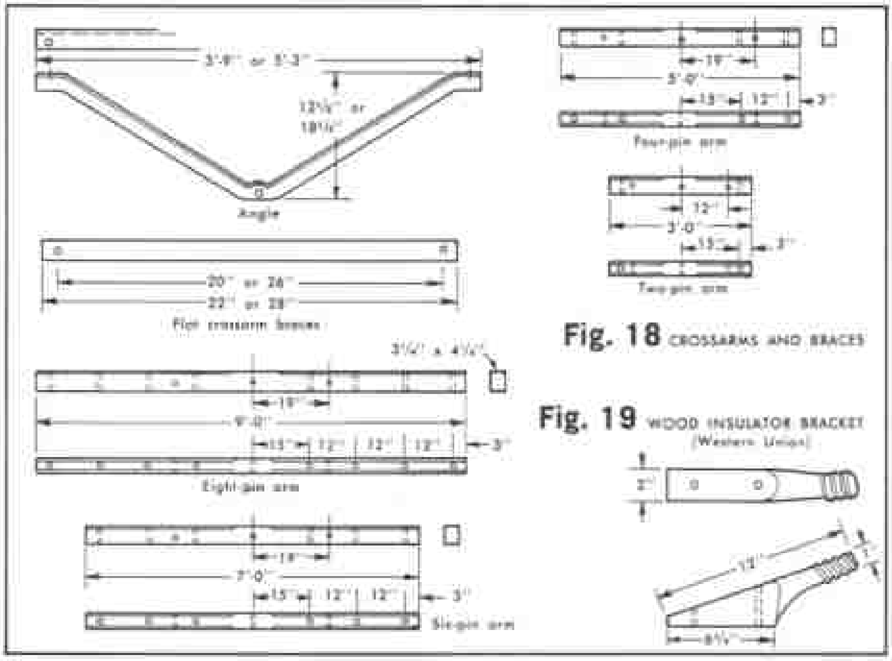


Fig. 18 CROSSARMS AND BRACES

Fig. 19 WOOD INSULATOR BRACKET (Western Union)

than 36" long should have braces 30" long fastened to the arms 19" from center. On heavy-duty service, these braces should be of angle stock. See fig. 18.

Double arms. These are for heavy duty and should be at ends of curves or where extra strength is needed. They should consist of two identical crossarms at the same level on opposite sides of the pole. Both should have the same bracing and insulator arrangement, with spacers between them when needed. See fig. 17.

Extension arms (alley arms). Where clearance on one side of the pole is a problem, the arms can be offset on the pole instead of being fastened at the center. They usually would have a single brace to the long side of the arm.

Wood insulator bracket. This is to hold a single insulator and was usually called a Western Union bracket. See fig. 19.

Use of crossarms

Feeders are the wires which carry the same voltage as the contact wire. Considering the voltage drop on the contact wire due to its size, the resistance can be reduced by having this additional copper wire directly connected to the contact wire every 1000 feet. This is the most common type of line used in addition to the contact wire. Sometimes it was old, worn-out contact wire with several strands twisted together. Some cities required that it be insulated.

One insulator on a wood Western Union-type pin held the feeder on each pole, while some lines used two such insulators. Some roads' feeders were carried on a wood crossarm on several insulators and some roads had angle iron crossarms to hold the insulators. When the poles were distant from the contact wires, such as on wide streets or when the span wires were supported by buildings or truss bridges, the feeders sometimes were carried on the span wires only 5 or 6 feet away from the contact wire. Whenever high track bridges, underpasses, tunnels, or any unusual track condition forced the poles carrying the wire work other than the contact wire away from the roadbed, the feeders were the only wires to remain over the roadbed and with the contact wire. Thus they could be tapped onto the contact wire to eliminate resistance.

Communication lines are next up the pole from the feeders. They were of similar wire size and arrangement as those found along steam railroads or highways and were for company telephones or telegraph or possibly commercial communications. At a given distance it was customary to have a transition bracket which shifted the relationship of the various wires to one another to prevent crosstalk, or one wire inducing its message to another. The number of insulators to a crossarm and the number of crossarms varied according to the needs of the road.

Transmission lines. If the railroad owned or was owned by a power company, it may have used the poles for carrying the high-voltage a.c. Over long distances, the railroad may have had automatic substations and sent out the high-voltage a.c. and d.c. to power these substations and carried the power from the substations. The high-voltage d.c. should be a two-wire system on a crossarm by itself and the a.c. would be a three-wire system at the top of the pole. There were some commercial types of special brackets in addition to regular wood crossarms for this high-voltage a.c.

When the track went over a high bridge or through a tunnel or underpass, the poles carrying these wires other than the contact wire and the feeders remained on the ground clear of any structures for easy maintenance. They were never strung though a tunnel or underpass, but if the bridge was over a wide river where an alternate route would be impractical, some special arrangement was made.

All of the above concerned one-pole bracket construction, considering the conditions where all the various types of wire would have to be carried on one pole. If span construction was used, the wire usually was split between the poles on both sides of the track. The communication lines usually were separated from the feeders and from the other power lines.

Some roads allowed the communication lines to be lower than the feeders and the contact wire.

Whenever a siding joined from that side of the track, these wires would raise to a point over the contact wire and then return to their original height when the siding was passed. When crossing a road or another railroad, the arrangement of the crossarms remained the same in relation to the top of the pole, but the poles became progressively taller, raising the

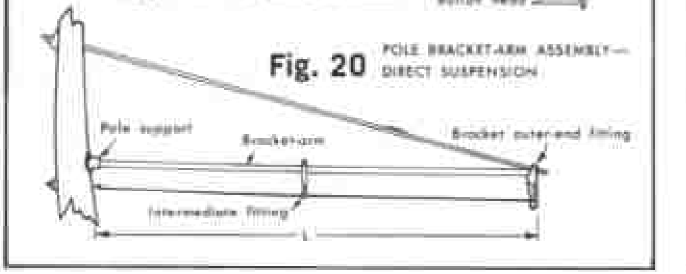


Fig. 20 POLE BRACKET-ARM ASSEMBLY—DIRECT SUSPENSION

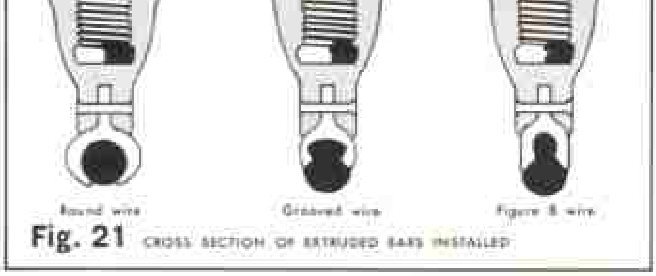


Fig. 21 CROSS SECTION OF EXTRUDED BARS INSTALLED

entire construction, with the exception of the contact wire.

Choice of supporting systems

Bracket support on side poles should be used for all single track where local conditions permit. This would be on private right of way or side-of-the-road operation where no other vehicles used the right of way common to the electric cars. Owing to the proximity of the poles to the track, bracket construction should be used on radii 300 feet or more on curves and on tangent track. See fig. 20. Bracket support should be used on central poles between double track where practicable.

Compound spans should be used when necessary to support the overhead of a series of tracks too closely spaced to permit poles between. This would be over yards or multiple-track main lines on curves. Refer back to fig. 2.

Bridge support was used only in special cases, as shown in figs. 9 and 10.

Supporting structures should be of such height that the lowest point of the contact wire in the streets and on interurban lines is 18 feet above the top of the rail under conditions of maximum sag, unless local conditions prevent; on trackage operating electric and steam railroad equipment and at crossings over steam roads, the contact wire should not be less than 21 feet above the top of the rail under conditions of maximum sag.

Brackets must be of sufficient length to allow 8" between hanger or strain insulator and the end casting. When poles are on the outside of a curve, the length of the bracket must be sufficient to allow for effect of the pole rake and the rail elevation.

Wire

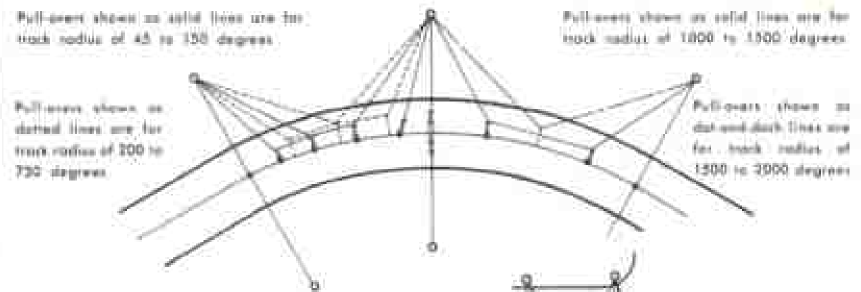
Contact (trolley) wire. There are three general types: round, grooved, and figure 8 as illustrated in fig. 21. This wire is drawn in low-resistance copper. It is available in about a half dozen different sizes, the largest being just over 1/2" dia. Considering this size and the weight of copper, it is easy to see why the load was so great on the construction. Some of the larger sizes weighed 1 pound per lineal foot.

The round type was held to the hangers by clinched ears (*i.e.*, ears that had a groove and had the two projecting edges hammered around the wire to hold it in place). This did not produce a particularly smooth path for the trolley wheel or slide and was not suitable for operation at high speeds.

The grooved type of contact wire had two small grooves in the top half of its circumference. This allowed for ears that had matching flanges to fit in these grooves to hold the wire in place. This left the bottom half of the wire's surface unobstructed for the smooth passing of the trolley.

The figure 8 type had its top loop gripped by the ear. This and the grooved wire were clamped with screws. Any surface of this wire which did not have contact with the trolley slide became a copper oxide color, a light blue-green. This would only be noticeable looking down on the wire.

Wire other than contact wire (guys, span wires, and other construction wire work) is of seven-strand twisted steel cable about the same size as the contact wire, and either is galvanized or plated to protect it from the weather.



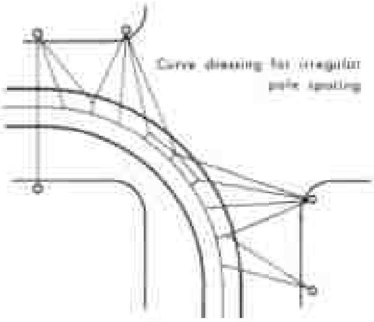


Fig. 23 CURVE DRESSING

Fig. 22 STRAIN ANCHORS

Pull-overs

The poles have guy wires to the ground to counteract the lateral pull of the wire, and there is also tension and pull parallel to the contact wire. This load will tend to upset the alignment of the wire on curves, so it is necessary to anchor the wire to prevent this. This anchoring should occur at the point of tangency at both ends of curves and occasionally on long stretches of tangent track. A strain plate is attached to the wire, which has fittings for the pull-overs. These are attached at all four points and are drawn to the poles, two in each direction. From the poles they are drawn to the ground as with pole guys. This creates a fixed point for the trolley wire, which will stop any strain from either direction. See fig. 22.

The chart shown here is used for determining the pole and hanger arrangement. Curves of even a sharp radius should give little trouble if constructed according to the chart. The angles should all be equal at each pull-over. All pull-overs should be attached temporarily and then adjusted until the curve is smooth. Offset of the wire should be observed according to the radius and the geometry of the car equipment used. Although complicated formulas are provided, the best results can be achieved with a bit of experimentation. The trolley wheel or slide will not be tangent to the wire on a curve if the wire is in the center of the track. The wire must be offset in order for the collector to have its groove reasonably parallel to the wire. This offset is to the inside of the curve and will get closer to the inside rail as the radius is decreased. If the curve is spiraled or has an easement, the wire should observe this too. See fig. 23.

Curve radius	Pull-over spacing	No. pulls between supports	Distance between supports
40 ft.	7 ft.	4	35 ft.
50	8	4	40
60	9	4	45
70	10	4	50
80	11	4	55
90	12	4	60
100	13	4	65
125	14	4	70
150	15	4	75
200-600	20	3	80
750	25	3	100
1000	33.5	2	100
1500-2000	50	1	100
Over 2000	100	0	100

Cars that have different geometry in regard to length, truck centers, etc., may give trouble. These conditions can be partially corrected by elevating the trolley base on low cars to be equal in height from the rail to the high cars. Pole length can also control this condition. The point of the trolley base pivot in relation to the rear truck kingpin is the most important thing to have identical on all cars.

Hangers, as to form of insulation, are of four general types: round top, fig. 24; cap and cone, fig. 25; insulated bolt, fig. 26; and yoke (uninsulated), fig. 27. As to use, they would be classified as straight line; single curve (pull-over); double curve (pull-over); barn, bridge, ceiling, or trough, fig. 28; and feed-in, fig. 29.

The straight line type of hanger would be used on a span support or tangent track with the span wire continuous and through the hanger fitting.

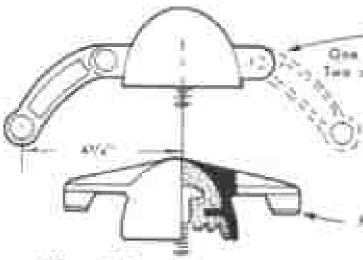


Fig. 24 ROUND-TOP HANGER

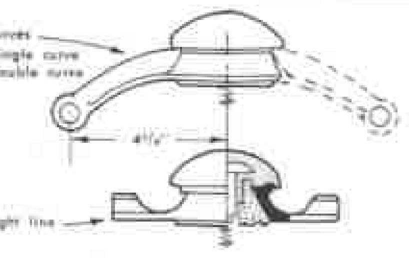


Fig. 25 CAP-AND-CONE HANGER

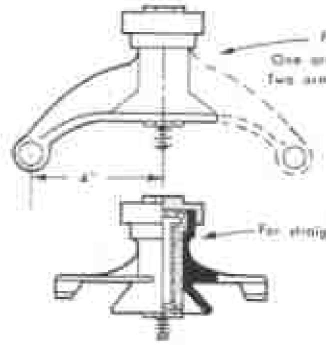


Fig. 26 INSULATED-BOLT HANGER

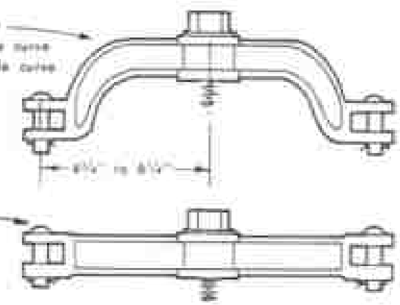


Fig. 27 YOKE HANGER

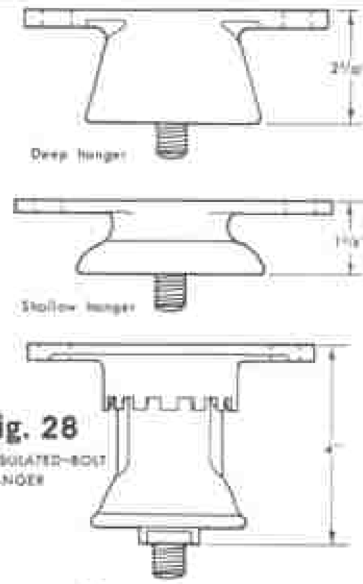


Fig. 28 INSULATED-BOLT HANGER

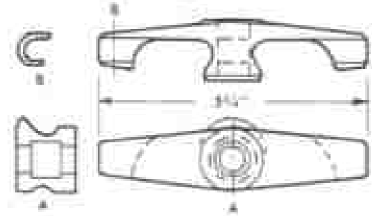


Fig. 29 FEED-IN SUSPENSION HANGER

Single curve would be a hanger having a fitting on one side only, allowing for a pull-over from that side. The pull-over would terminate at this hanger.

The double curve hanger would be for curves with a fitting for attaching the pull-over wire on one side and a duplicate fitting on the opposite side for continuing the wire to the single-curve hanger on the inside track. The pull-over wire would terminate at each side of the double-curve hanger.

Trough hangers are those having no attachments for wire supports, but having a flat top plate which can be bolted to the wood trough used for carrying contact wires in buildings, tunnels, and under low clearance bridges. These troughs are wood with a lip on the sides. They give some protection to those men working on top of the cars and also keep things from falling on the wire. When a trolley pole left the wire, they kept the pole from rubbing the side of the wire and then touching something above, such as the steel framing of a bridge or building, and causing a short circuit.

Feed-in hangers are used where the feeders are attached to the contact wire. They have no insulation or complicated mounting for the car but are designed to be a good electrical connection.

In addition to straight-line and single- and double-curve pull-overs for single wire, the same were available for parallel wire on 6'' centers. See fig. 30.

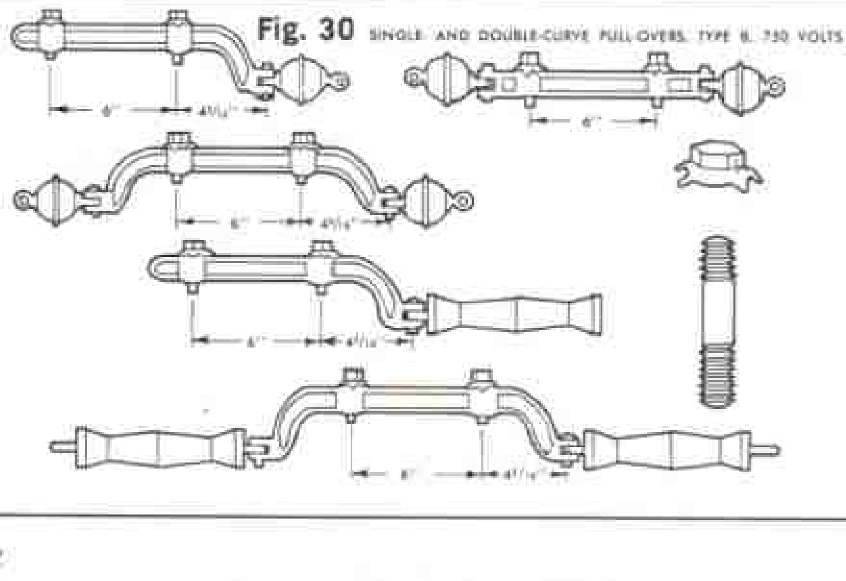
Their construction and installation are the same, but they would carry two parallel contact wires. They would be used, for example, where a double-track trolley line crossed a steam road at grade by going into single track and returning to double on the opposite side. Since the track route was probably determined by spring switches for returning to the right-hand track, wire frogs and single wire over the crossing were unnecessary. Instead both wires would be continuous using the hangers for parallel wires.

Another use was at a yard or car barn where cars (particularly single-end units) were backed against the trolley into storage areas. Having to back the car in a facing point direction over many wire frogs was very difficult and required a second man to attend the trolley pole. This was simplified by having each contact wire of each siding brought all the way out to the first switch on the lead. As each wire reached the point where a frog would normally be located, a hanger for parallel wire would be used. This hanger would be for two wires at the last turnout on the lead, for three wires at the second to the last turnout, and so forth.

These many wires extended to a point clear of the first turnout so that in operation, the motorman could stop the car, align the turnouts, set the pole on the wire that led into the proper track, and then proceed in reverse.

In interurban operation, sidings out on the line where cars operated at speed seldom had wire frogs but had a parallel wire hanger where the frog would be and then ran the two contact wires side by side at least several car lengths or to the next span or bracket support. A second hanger of this type was used and then the

Fig. 30 SINGLE- AND DOUBLE-CURVE PULL-OVERS, TYPE B, 750 VOLTS



siding's contact wire was pulled off to the nearest pole and anchored. When the siding was to be used, a stop had to be made to throw the switch and the pole set over on the siding's contact wire at the same time. Also, parallel contact wire sometimes was used on the backup leg of the wye.

Other fittings

Trolley ears are of three types and are extruded to match the three wire types as shown in fig. 21. These ears are screwed to the wire hangers described above and are fastened either by a clamp arrangement or are clinched around the wire as in fig. 31.

A **crossing** is a trolley wire fitting which allows the trolley wire contactor to pass over an intersecting wire of another track. Some are made rigid for a given angle, but the more common are adjustable to suit the angle of the track crossing. Some crossings of two lines required insulation owing to different sources of power on different voltages. See fig. 32.

Another type of crossing was used where a line using trolley pole collectors crossed a line using pantographs. Such a crossing is illustrated in fig. 33. The pantograph shoe, a wide horizontal bar, will slightly raise the wire from its pressure, causing the contact wire of any intersecting line to angle down from the horizontal and foul the pantograph shoe. Thus, the long rigid approach leading down to the crossing of the pantograph wire kept the pole collector contact wire clear no matter how high the pantograph raised it. The crossing of two pantograph lines at approximately 90 degrees would have to use this feature for both lines.

Trolley frogs are the fittings that allow the collectors to follow the car at turnouts, in the proper direction and on the proper wire. Their positioning should be roughly one-third of the distance from switch points to the track frog. This again, as with curves, should be adjusted according to the equipment used. It should be at a point where the collector's angle to the wire is about to cause it to leave the wire. See fig. 34.

Another type of frog had moving points similar to a track turnout so that a car or locomotive could back into a track and the pole would follow the correct wire. These were controlled by a system of rods and bell cranks from the turnout mechanism to the wire frog as shown in fig. 35.

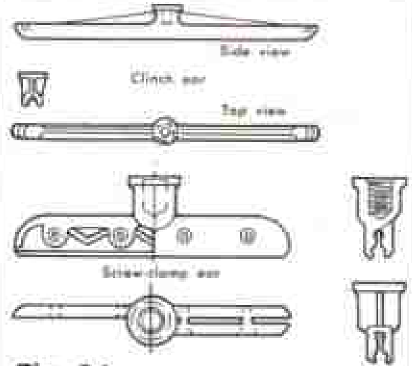


Fig. 31 TROLLEY EARS

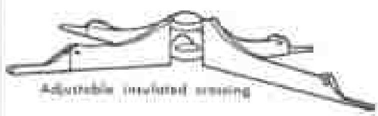
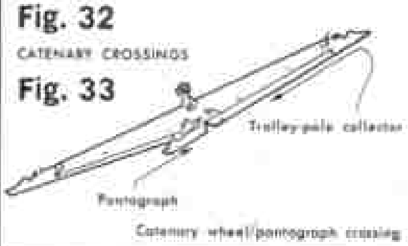


Fig. 32
CATENARY CROSSINGS

Fig. 33



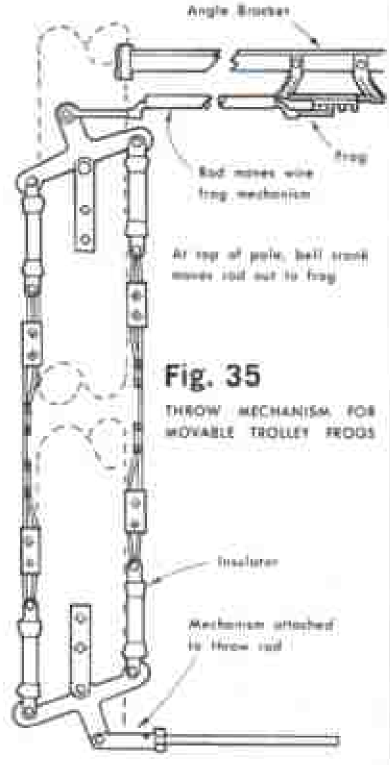


Fig. 35
THROW MECHANISM FOR MOVABLE TROLLEY FROGS

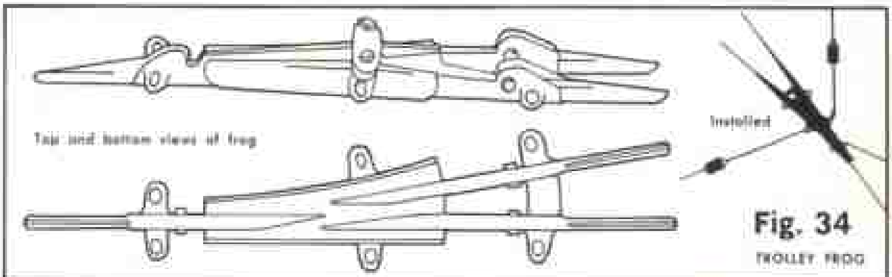


Fig. 34
TROLLEY FROG

Protection

Section insulators are insulated fittings in the contact wire which are used to separate the line at a point where the source of power is changed. See fig. 36. These generally are on tangent track, and all other pull-overs and supporting wire also must be insulated.

Section switch. This is a large knife switch, located in a box on a pole, capable of carrying the full line voltage. This is used to complete the circuit around a section insulator. It was commonly found on tracks going into car barns so that once a car was in the siding, power could be cut off to prevent injury to men working on the car. It also was used on sidings on private property, so that the line was dead when not in use.

Sometimes the line switchbox was located on a pole near the track but high enough so that it could not be reached except from the car itself. This protected it from someone on the ground. Some of the switchboxes had the handle long enough to project from the bottom to show that the power was off. Fig. 37 illustrates this.

Strain insulators are used in span construction, in guy wires, on both sides of all trolley wire hangers, etc., to provide insulation to the supporting structure from the trolley voltage. They are of two general types: porcelain, formed of one piece, with two holes for attaching the wire from both ends, fig. 38; and turned hardwood, with metal fittings at each end for the wire, fig. 39.

The wood type usually was confined to either side of the hangers at the contact wire and the porcelain types were used in most other applications. These porcelain insulators are known as the interlock type, since the wires, when in place, are looped through one another, although separated by the porcelain. In the event the porcelain broke, the wires would still be intact and carry the structural load. These insulators have a glazed brown finish.

Pin-type insulators, fig. 40, are made of glass or porcelain, and screw on a wood pin which in turn is mounted on a crossarm. Singly, they can be used on the Western Union type of pin as shown in fig. 19. These insulators increase in size as the voltage is raised.

In order to actuate powered turnouts, crossing signals, protective signals for the cars themselves, and other devices, various types of contactors were fastened to the wire. These circuits are completed by the wheel or slide contactor passing between the wire and the fitting shown in fig. 41.

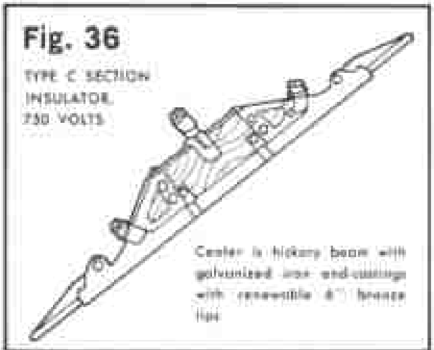


Fig. 36 TYPE C SECTION INSULATOR, 750 VOLTS

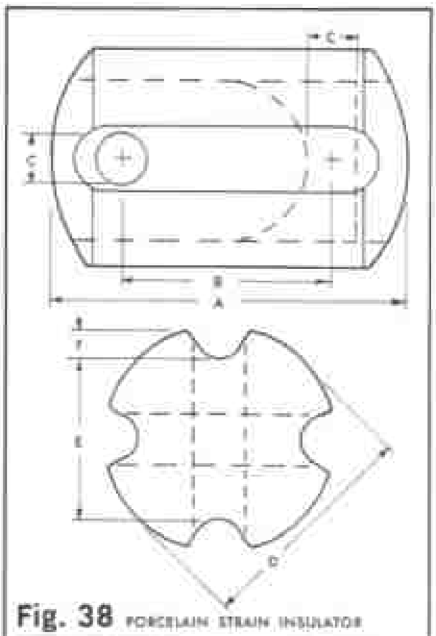
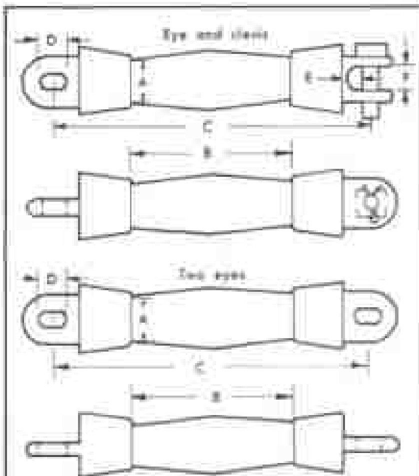


Fig. 38 PORCELAIN STRAIN INSULATOR

TRADE NO.	A	B	C	D	E	F	STRENGTH IN COMPRESSION
502	3¼"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10,000 lbs.
504	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	⅝"	12,000 lbs.
506	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15,000 lbs.
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18,000 lbs.



STANDARD COTTER BOLTS
[illegible] diameter for 1" and 1¼" strains;
[illegible] diameter for 1½" and 1¾" strains

	SIZE OF STRAIN			
	1"	1¼"	1½"	1¾"
A	1"	1¼"	1½"	1¾"
B	5"	5"	5"	5"
C	9½"	9½"	[illegible]	[illegible]
D	1"	1"	[illegible]	[illegible]
E	[illegible]	[illegible]	[illegible]	[illegible]
F	[illegible]	[illegible]	[illegible]	[illegible]

Fig. 39

Wirework over complicated track junctions requires special study according to conditions that may exist. It will be a collection of curves, frogs, and crossings requiring much experimentation.

Since overhead trolley wire could be hazardous in areas where cars were loaded, particularly with cranes that could strike the wire, the wire was sometimes omitted completely. The cars were spotted with "reachers" — any cars on hand used to reach cars too far from the wire to be reached by a locomotive.

When electric lines crossed over steam railroads, an added protection was provided for the trolley pole to prevent the car from being stalled on the crossing should the pole come off the wire. This was a wire mesh shield which was fastened to the hangers and arched over the contact wire. It was electrically connected to the contact wire so that if the pole did come off the wire, this mesh would have enough power to carry the car clear of the crossing. The mesh was long enough so that the pole was protected while any part of the car was on the crossing. See fig. 42.

Catenary suspension

Catenary overhead construction comprises all forms of trolley overhead construction in which the contact wire is supported from one or more messenger cables by hangers of such lengths as to produce a contact surface nearly parallel to the top of the track.

Simple catenary suspension is that construction in which the contact wire or wires are supported by a single messenger as in fig. 43a.

Compound catenary suspension, fig. 43b, is the construction in which the contact wire or wires are supported by the secondary messenger, which in turn is supported by the primary messenger.

The **contact wire** is the wire with which the current collector makes contact.

Primary messenger. This is the cable which carries the load of the contact wire and secondary messenger (if any) together with the necessary hangers. It has two basic characteristics: strength and conductivity. For these reasons, it can be of either steel or copper. Both have their advantages and disadvantages.

The **secondary messenger** is the cable which is attached by hangers to the primary messenger and in turn supports the contact wire. It also can be of either steel or copper with the same advantages or disadvantages in regard to strength and conductivity.

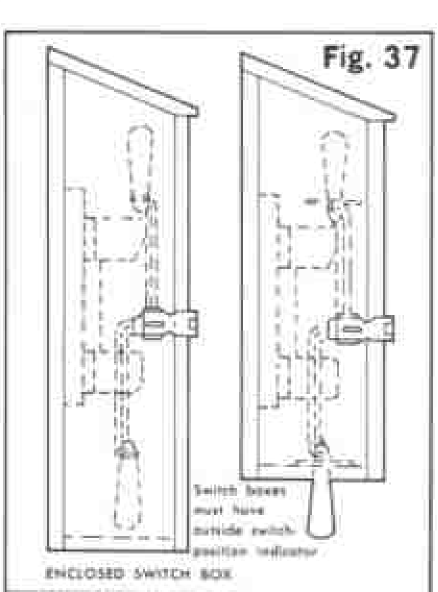
Hangers (catenary type) are the devices used for suspending the contact wire from a messenger or the secondary messenger from the primary messenger. Primary hangers, figs. 44, 45, and 46, are used for suspending the secondary messenger from the primary messenger. Contact wire hangers are used for suspending contact wire from the secondary messenger. See fig. 47.

The supporting systems and supporting structures for catenary suspension are the same as for direct suspension.

Poles on tangent track should be spaced 150 feet apart in most instances. Greater spacing can be used providing the poles are of suitable strength. Pole spacing is decreased on curves according to the radius. Pole spacing variations should be in accordance with the multiples of the hanger spacing.

On private right of way, the poles should be 3 feet plus half the width of the cars from the center line of the track. This is increased proportionately on curves. Since the weight of the catenary construction is so much greater, in span construction it is almost always necessary to have back guys for each pole. These are guy wires installed at right angles to the right of way, the same as the

Fig. 37



ENCLOSED SWITCH BOX

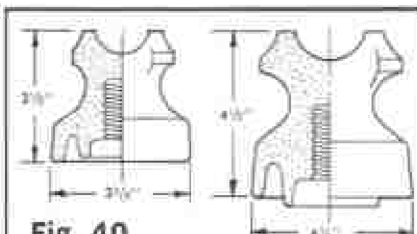


Fig. 40 FEEDER PIN-TYPE INSULATORS

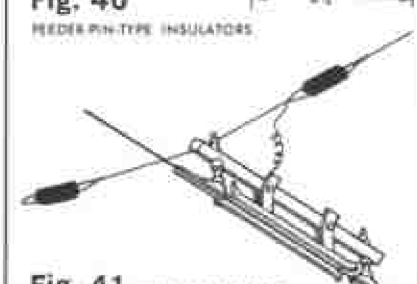


Fig. 41 WIRE CONTACTORS

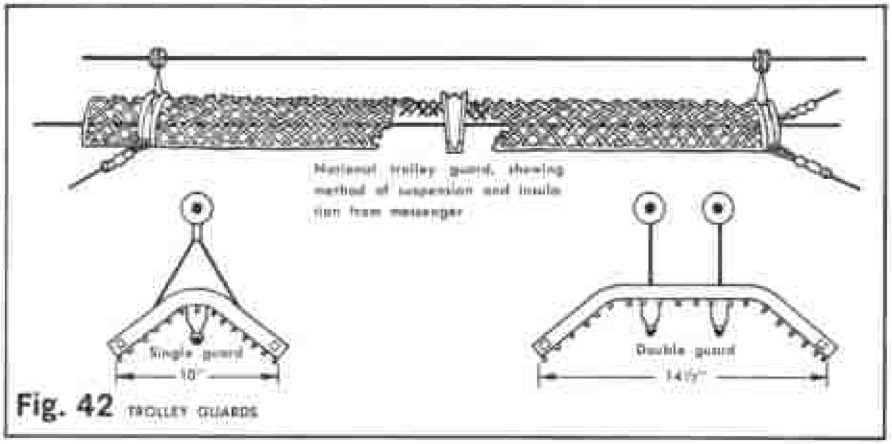


Fig. 42 TROLLEY GUARDS

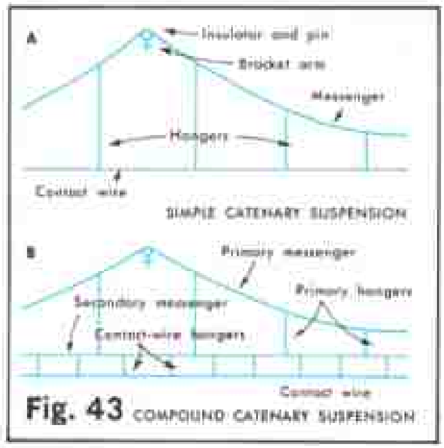


Fig. 43 COMPOUND CATENARY SUSPENSION

guys described for direct suspension.

The type of supporting system, like the supporting structure, will be governed largely by local conditions such as length of span, type of supporting structure to be used, weight of catenary system, and number of tracks spanned. In general, the simple cross span support should be used on all curves of less than 300-foot radius and on all double track where central bracket poles are not used. Compound cross spans or steel bridges should be used where more than two tracks are spanned. Bracket support can be used on either single or double track where practicable.

Compound cross span construction should be used where more than two tracks are spanned to keep the contact wires in the same horizontal plane.

Contact wire should be installed at a uniform height of not less than 16 feet above the rail. On trackage operating both steam and electric or at steam road crossings, it should be not less than 22 feet above the rail. Whenever a change in wire height is necessary, this should not take place at more than 1 per cent relative to the rail.

Hangers (refer back to figs. 44, 45, 46, and 47). The length of the hangers is relative to the span being used. They generally are spaced about 15 feet apart, although they can be up to 30 feet where pole collectors are used. The primary hangers have a loop on the top which allows the collector to equalize its pressure because the wire is able to deflect slightly upward. The secondary hangers generally are bolted halves to grip the secondary messenger and the contact wire. The secondary hangers sometimes are spaced in between the primary hangers in equal numbers or are spaced two to each space between the primary hangers but on constant centers. See fig. 43b.

The **backbone** is the wire running from pole to pole and to which the pull-overs are attached. This support was used on curves to provide the points for pull-overs instead of having a pole for each. It should start at the point of tangency with an anchor and run from pole to pole at a constant height equal to the overhead and end with an anchor at the opposite point of tangency of the curve. The support poles on the outside of the curve carrying the backbone should all have back guys.

Frogs. An actual wire frog fitting is not needed if the construction is to be for pantograph collection. The overhead should follow the center line of the track joining the tangent line and then be projected onto a point where it can be attached to a pole and have a guy to the ground. For pole collection, the same location methods and hanging should be used as in direct contact systems.

Catenary bracket construction, fig. 48, shows two methods of bracket construction. The primary messenger goes over the top of the bracket supported by an insulator, with the secondary messenger (if any) and contact wire suspended only by the hangers. Any span, bridge, or bracket support always occurs on center between primary hangers. To keep the wire vertical at the brackets, a pole bracket steady assembly often is used, as shown in fig. 49.

Catenary on curves is of two types: vertical and inclined. The vertical, fig. 50, has the messenger directly over the contact wire at all times, and the inclined catenary, fig. 51, has the messenger pulled to the outside of the curve. Thus, it becomes the backbone with each hanger a pull-over.

The pull-overs for vertical catenary are used much like direct suspension. The messenger and contact wire, being always in vertical alignment, have to be pulled equally on curves. The typical vertical pull-overs are shown in fig. 52. The primary hangers, varying in length, would be typical of that shown in fig. 44. These would remain the same on curves.

The advantages of inclined catenary are as follows:

The use of a backbone is practically eliminated.

Inclined curve spans may be made the same length as the tangent spans on all except short radius curves. This reduces the number of supports required.

Fewer pull-overs are required. (None are required on curves of less than 4 degrees.)

The contact wire closely follows the center line of the track, thus eliminating

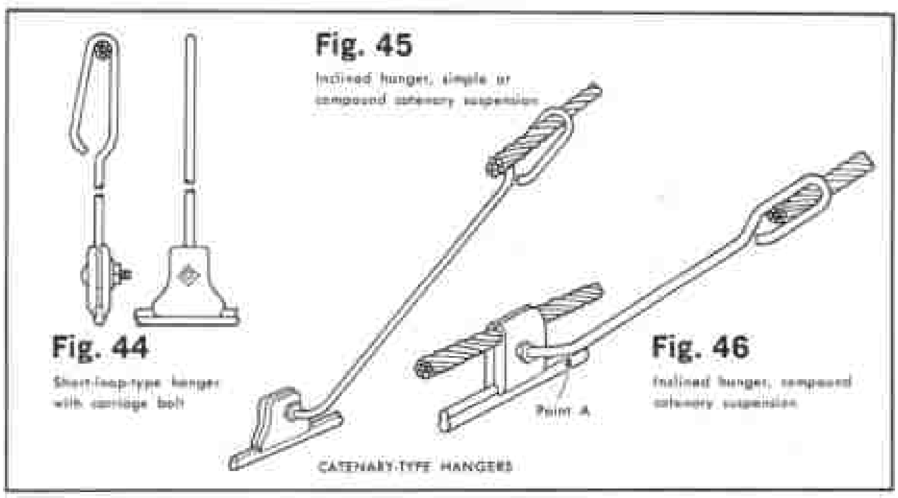


Fig. 45 Inclined hanger, simple or compound catenary suspension

Fig. 44 Short-loop-type hanger with carriage bolt

Fig. 46 Inclined hanger, compound catenary suspension

CATENARY-TYPE HANGERS

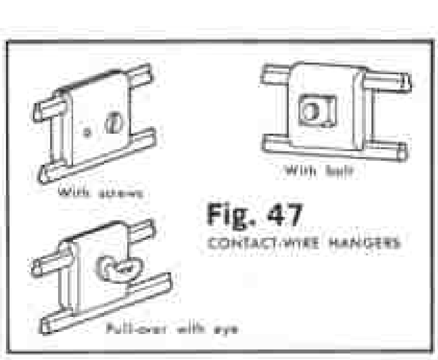


Fig. 47 CONTACT-WIRE HANGERS

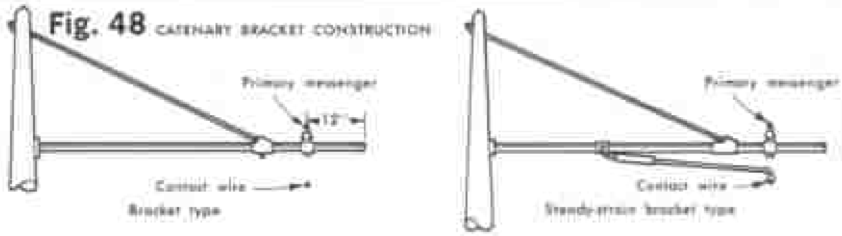


Fig. 48 CATENARY BRACKET CONSTRUCTION

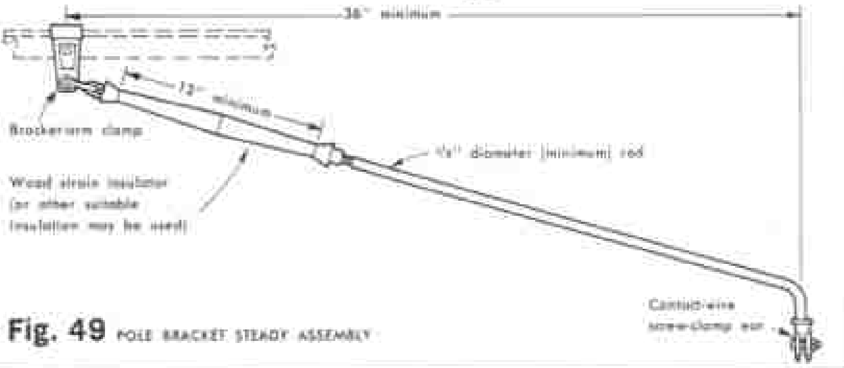


Fig. 49 POLE BRACKET STEADY ASSEMBLY

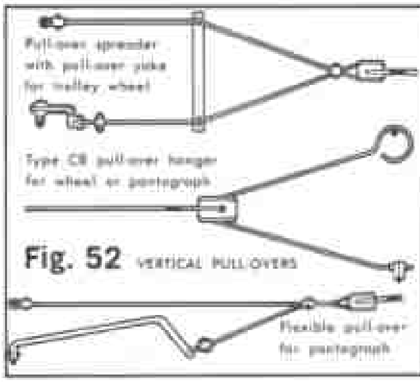


Fig. 52 VERTICAL PULL-OVERS

any sharp angles in the wire which might overstress it or cause sparking when the collector passes over it.

Fewer insulators are required. This is important with high voltages.

Hanging this type of curve requires the hanger shown in fig. 45 for simple catenary and the hanger shown in fig. 46 for compound catenary. The secondary hangers, fig. 47, are the same as fig. 46 with the hanger supporting element fastened from the side. This is to keep the secondary messenger over the contact wire. This vertical alignment is maintained by controlling the angle of the bend at point "A" in fig. 46. The transition from vertical catenary, as on the tangents, to the incline would occur in the span over the easement on the curve.

Spacer links, fig. 53, are used in either a fixed version or adjustable version to control spacing between the contact wires just beyond a wire frog. This is to keep the contact wire in line with the angle of the frog fitting. To construct another support span wire would be costly. The spacer link will work just as well. In catenary, it has many applications similar to this, keeping contact wires at turnouts at the proper angles.

Either poles or pantographs can be operated on catenary systems. Direct contact systems are designed for pole operation, but also can be used for pantographs under certain conditions. The clearance at the wire for the pole only requires the bottom surface of the wire plus an inch or so on each side for its flange. The sides of the wire must be relatively free on at least the bottom half of the circumference so as not to foul these flanges. If the pressure of the pole collector raises the wire so that the span and pull-overs angle up to the contact wire instead of down, this is no problem. In pantograph operation, the long, flat shoe of the pantograph would foul on these. This is why the span wires and pull-overs are all well above the contact wire or angle up. The hanger connection to the contact wire is not as critical since the pantograph bar only touches the bottom edge of the wire.

Operations where both pole and pantograph are used also require special treatment. Since the pole operation requires wire frogs and crossing frogs and the pantograph does not, these frogs need a smooth surface and a gentle approach angle to keep them from fouling the pantograph shoe. Using both pole and pantograph on the same line is not practical. Overhead for pantographs does not follow a straight line, for it would eventually wear grooves in the pantograph shoes which would catch the wire and damage it. Therefore, the wire is staggered from one support to the next so that it keeps a wide path worn on the pantograph shoe. For trolley operation, this would wear an oversize groove in the wheel which would give trouble at frogs or curves.

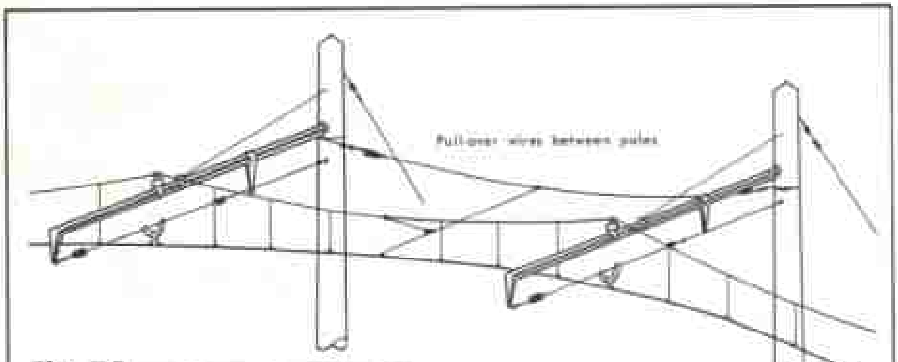


Fig. 50 CURVED CATENARY—VERTICAL TYPE

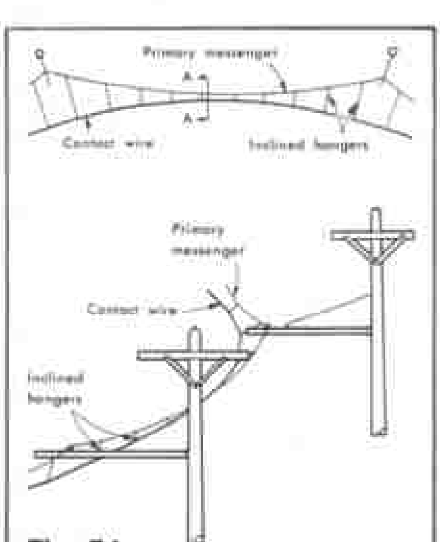


Fig. 51 CURVED CATENARY—INCLINED TYPE

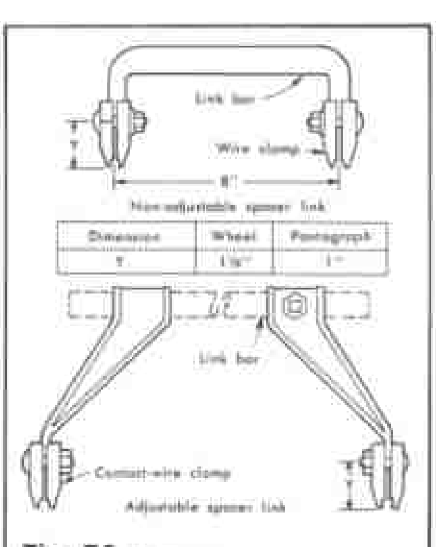


Fig. 53 SPACER LINKS

Modeling overhead

Learn how to hang trolley wire

BY JOHN T. DERR AND RICHARD H. WAGNER

IF your street trackwork is as perfect as you can make it, and your paving is finished, we'll begin to hang overhead trolley wire.

Here is a list of tools and materials that are needed. Not all of the tools are necessary, but they'll make the job easier to do:

Small pencil-type soldering iron: Soldering irons can be purchased in parts, enabling the individual to assemble a unit to meet his own needs. For our work, I suggest using an Ungar No. 777 handle priced around $1.90. Use this with an Ungar No. 1235 heating element, a unit rated at 37½-44 watts and priced at $2.05; or use a No. 4035 unit rated at 47½-56½ watts for about $3.38. The screw-in tip, Ungar part No. PL333 or equivalent, is available for about 65 cents. Assemble and heat the iron ("iron" will be used hereafter to designate the completely assembled handle-element-tip). When hot, melt solder generously over the tip to tin the iron. The excess can be wiped off with a cloth.

Solder: I recommend 1/32" diameter Kester "44" solder with a rosin flux core. You will find a paste flux useful at times too.

Needlenose pliers are necessary for making small bends.

Side cutters: These are useful for cutting wire to length.

Reverse-tension tweezers: Priced less than a dollar, these are indispensable for wire work. Unlike regular tweezers, they open up and release their grip when you squeeze them. If you are working in 1/4" scale, try to find a pair 5" long; they can be used for instant measurement of wire height, as a plumb bob for wire centering, and as a heatsink for soldering wire fittings. If you do much wire hanging, you will soon find a need for special clamps or tools that you can fashion yourself.

Wire: Phosphor bronze wire is still the best for running wire (trolley wire). Use No. 24 wire (.02" diameter) in O gauge, and No. 26 wire (.016") for S and HO gauges. For span wire, pull-offs, and other supporting wires, I suggest .013" spring brass wire (No. 28) for all gauges.

Poles: Poles are made from 1/4" wood dowels in O gauge, and city-type steel poles from 3/16" round brass rod. S gaugers can use 3/16" rounds in brass or wood, and HO'ers will find 1/8" brass tubing or wood dowel satisfactory.

Notes on overhead

Trolley wire suspension for streetcar and interurban operation is shown in fig. 1. Two support systems are illustrated, bracket and simple cross span. The bracket type is used over single track; the simple-span suspension can be used on single or double track (although it was mostly used on double track), or in yards. Fig. 2 shows how trolley wire is positioned over various track formations. Notice how the basic wire formations shown in fig. 1 are repeated in fig. 2.

Overhead wire normally is hung 20 scale feet above the rails, although there may be variations to suit special conditions. This is 5" in O gauge, 3.75" in S, and 2.75" in HO. Poles are spaced about 100 scale feet apart on straight track, which is 25" in O gauge, 18.75" in S, and 13.75" in HO. On curves, poles are spaced closer together; the sharper the curve, the less space between poles.

As an aid for finding the exact location of each pole in relation to the track, you may find it helpful to make a .5" thick wood template from the patterns in fig. 3, shown in 1:48 scale (1/4" scale or O gauge), 1:64 scale (S), and 1:87 scale (HO). For lining up poles on straight track, use the edge marked "S." Use the edge marked "C" for curves, where poles are spaced slightly farther away from the track center than on straight track. The "C" edge of the template also should be used where curved and straight track join. The template can be used to locate the nominal height of the trolley wire above the rails; a small flathead screw inserted at each top corner of the template will aid in locating poles at the correct height in relation to cross spans and trolley wire. See fig. 4.

Before you begin erecting poles on your trolley line, it is a good idea to locate them on an accurate plan of the track route, using fig. 2 as a guide. Remember to position your poles carefully to properly carry the strain of the trolley wire. Determine the number of poles you will need, both with and without bracket arms.

Pole construction

Construction of bracket and cross-span poles can follow many different methods but we will discuss only a few here. For wood bracket poles, this first method is quite simple and effective and can be used for all gauges. Start by cutting the poles to length following the template provided in this chapter (fig. 3). Next drill a hole a little more than halfway through the pole at point A in fig. 5. This hole should be 1/16" in diameter in O gauge, and 1/32" for S and HO. With a No. 80 bit, drill a .013" hole (suitable for all three gauges) at points B

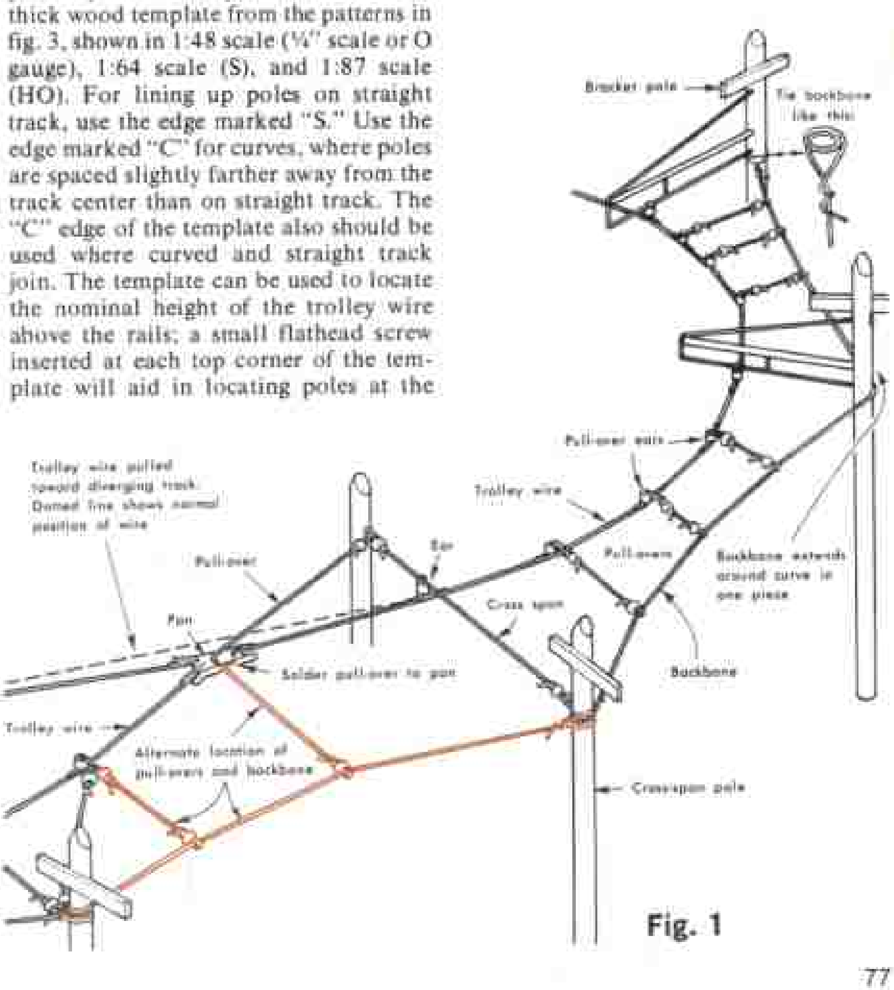


Fig. 1

and C. Cut off a length of spring brass wire: about 4" for HO; 6" for S; 8" for O.

Using fig. 5 as a guide, shape the spring wire with a needlenose pliers into a one-piece bracket-arm rod/cross-span wire that will extend on the model from point B around the end of the bracket arm (D) to point C. Solder it to the end of the brass rod at D and cut the rod to length. Use 1/16" brass rod for O gauge and 1/32" for S and HO. Coat the end of the rod with a small amount of epoxy or glue and insert it into the trolley pole at point A. Now insert the ends of the spring wire through the holes at B and C (if you are using cast hangers, put one on before placing the wire through the hole at C) and trim them off about 1/8" from the hole; bend the ends over to keep the wire from pulling through the holes. It may help to secure them in place with a small amount of glue. If you want to add a little extra detail, solder a small piece of wire between the bracket arm and the cross-span wire at E to represent a cross-span support.

Use metal poles at points where you want current fed from under-table wiring up to the trolley wire. Usually these "feeder" poles are located about every 6 feet. Construction of all-brass poles is only slightly different than that of wooden poles: The hole at A should be drilled all the way through if the pole is of metal tubing because the rod will have to rest on both walls of the tube for support. The brass rod and the spring wire are secured with solder. Excess solder should be filed smooth.

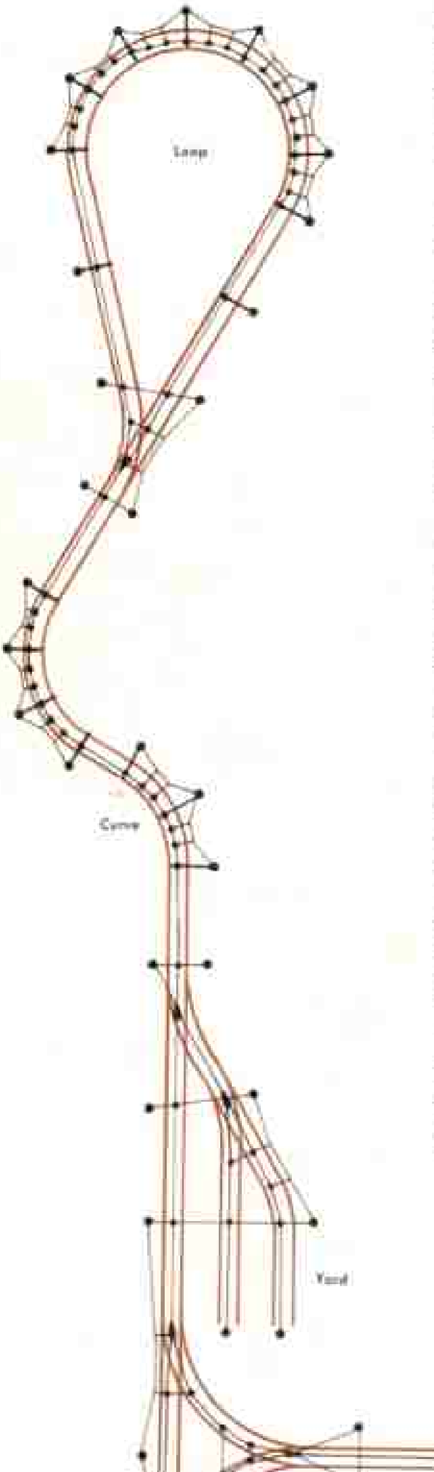
There are several procedures you can follow when constructing pole and cross-span assemblies for use with simple cross-span overhead. Fig. 6 shows two ways that are suitable for larger gauges (O and S). The method in fig. 6a utilizes very small cotter pins. Drill a hole in the pole the same diameter as the cotter pins and insert them from the track side. Cut off all but about 3/16" of the pin and bend the ends around each side of the pole. They will be almost invisible after the pole is painted dark brown or black. Fig. 6b illustrates a better technique. Use about the smallest screweye available from the hardware store. Drill a hole in the dowel slightly smaller than the diameter of the screweye base and twist the screweye in with the aid of the needlenose pliers.

A method especially suited for making HO cross-span poles (although perfectly acceptable for O and S too) is one previously described for bracket poles. Drill a .013" hole near the top of the pole and insert brass spring wire from the track side. Cut off all but about 1/8" and bend over to prevent the wire from slipping out. Although the brass wire should fit snugly into the .013" hole, a small amount of white glue applied to the wire ends will help secure it after final adjustments are made.

Simple crossarms for 1/4" scale can be made from wood strips 1/8" square by 1 5/8" long; for S, 3/32" square by 1" long; for HO, 1/16" square by 3/4" long; however, styles of crossarms varied greatly, so you may wish to study some of the different styles illustrated in the "Traction Overhead" chapter to determine the kind you will need for your traction line. Wagner Car Company, 59 Euclid Avenue, Cincinnati, OH 45215, markets ready-made crossarms: No. C-425 has three large dummy insulators and a diagonal brace; No. C-426 has four small dummy insulators and two diagonal braces. The C-425 can be used for 1/2" scale and S; C-426 can be used for 1/4", S, and HO. Kemtron Corp. Inc., 748 Fulton Street, Fresno, CA 93721, lists six types of crossarms for O gauge in addition to Western Union-type of insulator mountings. Be sure to file a slot in the pole for a snug fit of the crossarm before cementing it in place. For those of you who would like to obtain ready-made poles of either the bracket type or cross-span type, E. Suydam & Company, Box 55, Duarte, CA 91010, markets them.

With your track plan as a guide, mark the location of each pole on your layout. Power leads can be soldered directly to the pole base extending through the underside of the table. However, if you have to run a power lead to a section of overhead held up by a wood pole, try this method: Solder a short piece of black insulated No. 26 hook-up wire to the end of the span wire. Run it down the pole on the side opposite to normal viewing and through a small hole in the table. Because the resistance of thin wires causes power losses, it is necessary that this thin feeder line be spliced into a heavier wire immediately below the tabletop. Tie the small wire to the pole with black thread — you never will know it was there. Remember to use the template to space the poles the correct distance on either side of the track. Incidentally, notice that the bracket poles are almost always erected on the outside of the curve.

Drill holes into the tabletop for erecting the poles. Holes should be drilled small enough so that poles will fit tightly into them. Tap the poles gently into the holes until the eyebolts line up with your template. I don't glue the poles in unless the hole is oversize; this allows for vertical adjustment. If your baseboard is too thin to support a pole, glue a short piece of 1" x 2" wood under the pole location before drilling the hole. Plant bracket poles vertically. In raising plain poles



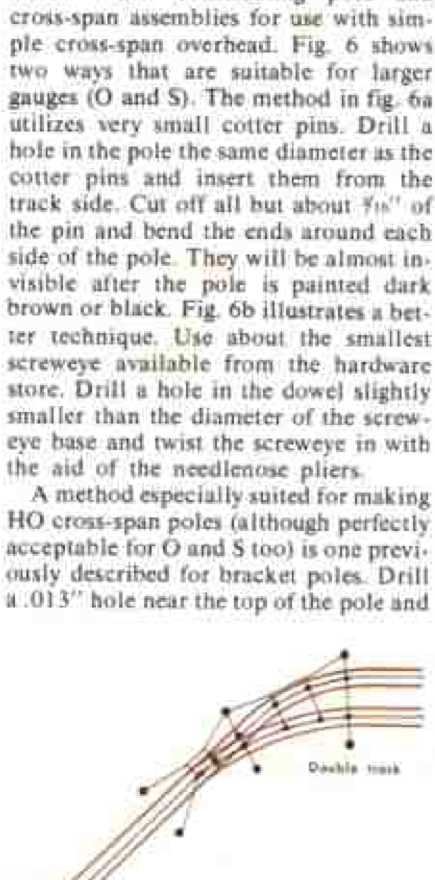


Fig. 2 SUGGESTED LOCATION OF TROLLEY WIRE RIGGING OVER VARIOUS TRACK FORMATIONS

used in cross-span construction, drill holes at a slight angle to give poles rake. If there still isn't enough rake, force a spike between the pole and the hole to give it more lean.

Stringing overhead

We will start the actual stringing of overhead with the cross-span wires found on simple-span construction. Purchase a vial of round black "Indian beads" of the smallest size that will permit two thicknesses of our spring brass wire to pass through the hole. Thread a bead onto the wire, loop through the pole eyebolt (if you are using eyebolts on your cross-span poles) and back through the bead again. Gently squeeze the span wires together at the eyebolt and slide the bead up as close to the eyebolt as possible. Lightly pull the span wire taut with one hand and bend the short end protruding from the bead away from you with the other hand. Clip this off about 1/8" from the bead. Now cut your span wire about 1" longer than needed to reach the other pole. Slip on a bead and repeat the process. As you make the loop through the second eyebolt, make sure the cross-span wire between the poles remains fairly taut. I usually do not trim excess wire from this second side until final adjustments are made, and I am satisfied with the whole section. The brass wire will withstand several reworkings before it breaks. You will find that this system is adjustable and requires no soldering.

Trolley wire is hung from hangers or "ears." Those that go on the cross spans and brackets can be made as follows: First, hang a U-shaped piece of wire over the span wire and slip a tiny eyelet, a short bit of 1/16" brass tubing, or even a bead in place as shown in fig. 7. Then bend the ends over like a cotter pin and trim off extra wire. (NOTE: The wire used for ears should be no larger in diameter than the running wire.) Eyelets and beads are more uniform in size than splices of tubing, although some modelers prefer to use nothing at all. Curved sections of overhead are strung with pull-over hangers and are constructed similarly to regular hangers; see fig. 7b.

Do not solder the hangers to the spans as yet. No dimensions are given for the hangers; just make them as small as possible. Beads are preferred for making HO hangers since eyelets and tubing sections may be oversize. Ready-made hangers for both straight and curved track are available from Wagner Car Company, E. Suydam & Company, and Kemtron Corp. These parts are preferable for appearance and they save time in wire hanging, but they do involve a little more expense.

Tie the backbones in place around all curves. The backbone, together with pull-overs and hangers, holds overhead wire in its correct position over curved track; refer again to figs. 1 and 2. Tie one end of the backbone wire to the pole at the beginning of the curve, lead it around the curve in one piece, and tie the other end to the pole at the end of the curve. Fig. 1 shows how to tie the wire. The backbone should be just barely taut. The wire gradually will tighten itself as the pull-overs are fastened in place. On a short, abrupt curve, no backbone is necessary; pull-overs can be attached directly to the pole. Note "Short, abrupt curve" in fig. 2.

Most O-gaugers cut the trolley wire into blocks, with the running rails bonded throughout — usually the reverse procedure of the smaller gauges. Blocking trolley wire in O gauge is easy to do, and almost a necessity if you expect to signal. Besides, that's the way the prototypes do it. However, it does mean the

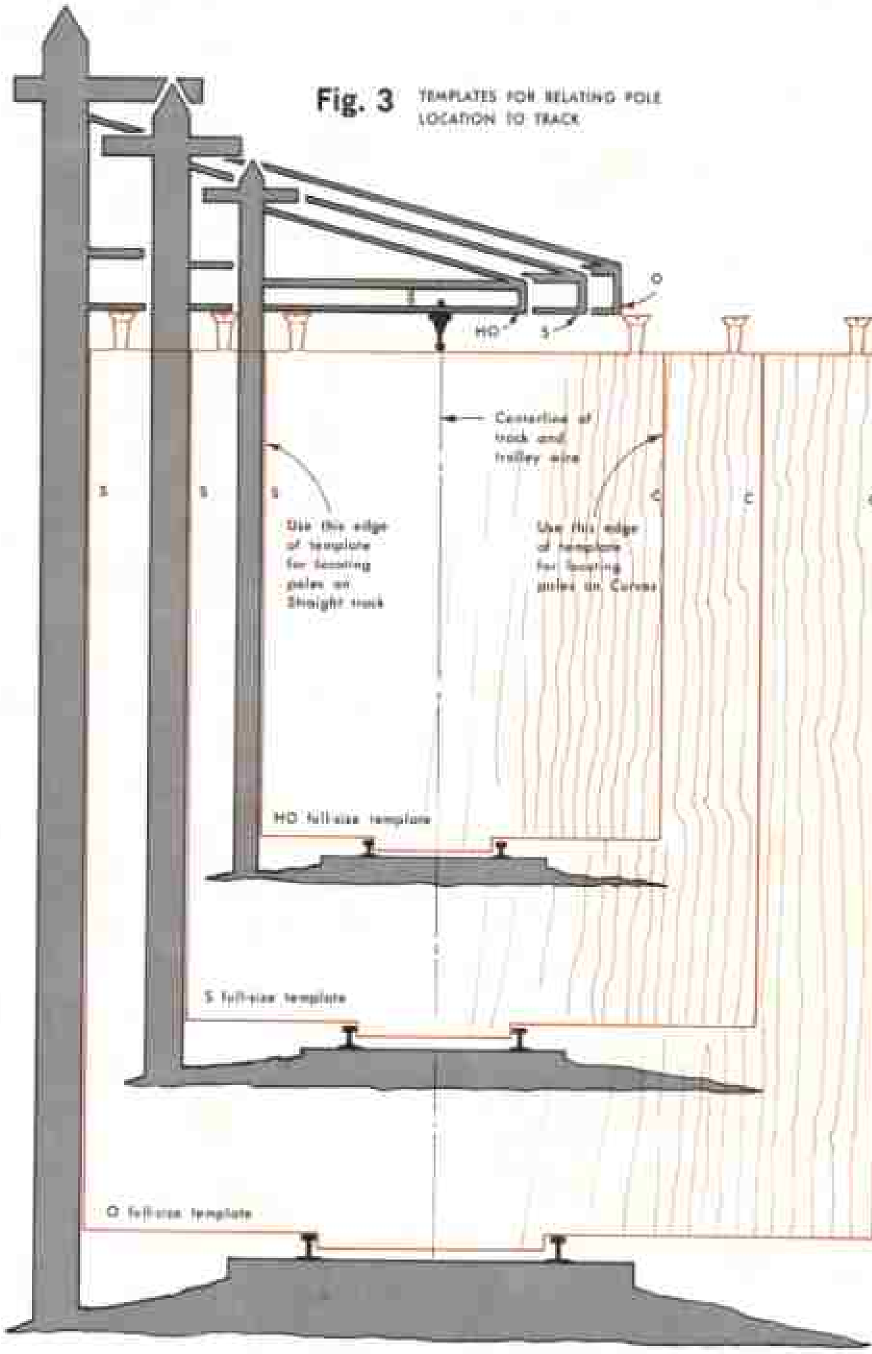


Fig. 3 TEMPLATES FOR RELATING POLE LOCATION TO TRACK

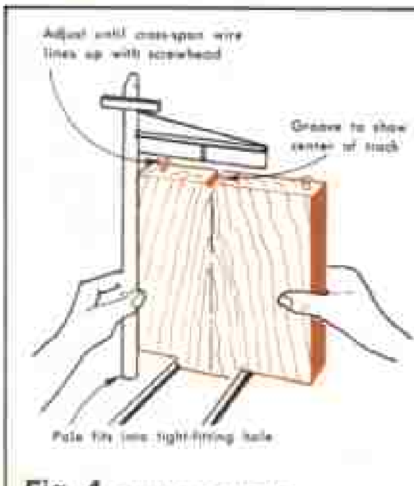


Fig. 4 USING THE TEMPLATE

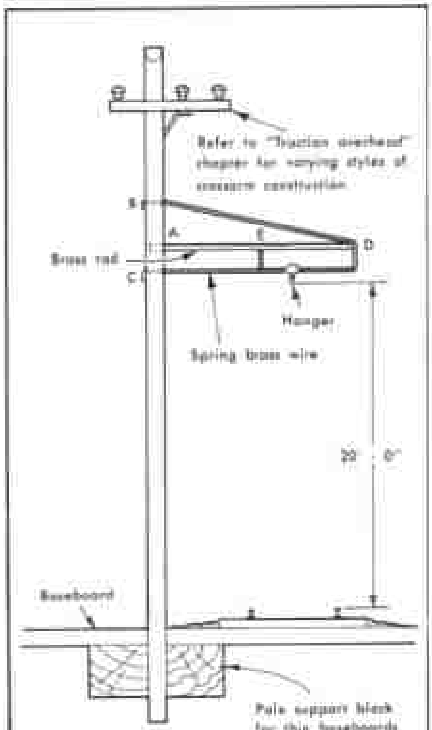


Fig. 5

liberal application of insulators to the overhead, especially on span wires between two tracks, at the ends of a block, and on span wires and backbones that span a block insulator on a wire. If you have a friend who makes printed circuit boards, you have it made. Ask him for his scraps of 1/32" thick glass epoxy material known in the trade as class G-10 (you'll want it with the copper removed). Saw it into strips 3/16" wide and drill No. 65 holes in pairs as close together as you can get them. Then slice the strips into sections about 1/8" long, each with double holes. That's your insulator. If glass epoxy material is not available, substitute it with some other non-conducting material such as plastic (styrene should work well). To install the insulator on the trolley wire, cut the wire at the point where you want to locate the insulator. Bend the wire ends sharply with the pliers and insert the ends into each of the holes from underneath. Bend the ends back and cut off part of the excess, leaving a .25" tail. See fig. 8. When using this method of insulator installation on span wires, twist the end of the span wire around itself several times before trimming it off.

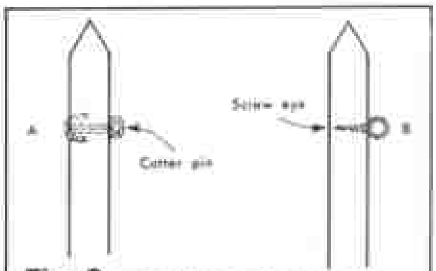


Fig. 6 EYEBOLTS FOR CROSS-SPAN POLES

Unwind your spool of trolley wire *under* all the cross spans and brackets as far as possible around the line. Continue through all track turnouts on the straight side. If your layout is a loop, let the wire begin and end at the same turnout. Now, temporarily fasten the wire to the cross spans over curved trackage with paper clips. Use an opened clip at each pole where you have a backbone attached, by hooking one end around a pole and the other to the trolley wire. Your wire should stay over straight track without support. Fasten one end of the wire to the second pole beyond where the two ends meet. Or better yet, use a portable wire anchor. This is a block of wood exactly as high as your wire should be. Clamp or screw the block to the layout table. The wire can be clamped by placing a small wood screw and washer over the wire so as not to nick it. Now pull the other end of the wire until it is *barely taut*. Tie it beyond the point where the ends come together. Handle the wire very carefully; if kinked, it may break.

Some modelers prefer to hang the wire over the curves first. I prefer to start over tangent track, using a temporary clamp on the wire to maintain tension while soldering it to the bottom of the hangers. Make sure the "pull" or tension is the same at any point on the layout. Use a minimum amount of solder and make certain that wire and hangers are well cleaned. Progress your way around the layout, soldering one ear at a time.

You will need a lot of ears for the curves, similar to the ones used on the span wires. Again, these are shown in fig. 7b, for single or double wire, if you wish to make them yourself. As mentioned previously, however, the use of purchased lost-wax castings greatly simplifies hanging the wire. Unused ears on the wire can be clipped off if not needed, although I certainly recommend you not do so until all wirework is finished and approved.

Space the pull-overs equally around curves. The number required depends on the radius of the curve, but it works out well to use an odd number if possible: 1, 3, 5, etc. The more pull-overs you use, the more the overhead wire will conform itself to the track radius. Notice that the trolley wire actually does not curve, but follows the track in short, straight segments. Refer back to fig. 1.

Now, along the curved trackage, solder an ear to the running wire halfway between the bracket poles. Use a small needlenose pliers, reverse-tension tweezers, or a ruling pen to clamp one end of the ear. Solder the end opposite the clamp, move the clamp to the soldered end, and use your iron again. See fig. 9. WARNING: Do not use acid flux solder for any of this work. To attach a pull-over between the ear and the backbone, bend a convenient length of spring brass wire fish-hook fashion and insert

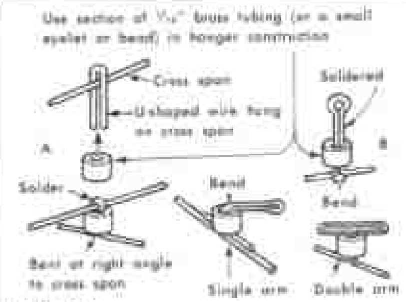


Fig. 7 HANGERS

Fig. 8 INSULATORS

Fig. 9 SOLDERING HANGERS

the hook end into the eye of the pull-over ear as shown in fig. 1. You can leave it hook-shaped, twist it several times, or secure it with a bead. A lot will depend on working space. In congested yard work, wires will be too numerous to use anything but a simple loop. Loop the free end temporarily in place on the backbone. Attach the rest of the pull-over ears and pull-overs in the same manner. Now, solder all trolley wire to the cross-span and bracket hangers, but do not solder the hangers fixed as yet.

Get one of your trolley cars and set it on the track with pole up and the shoe against the wire. As you push it along, notice how the pole is pulled over to the inside of the curve. The correct position of the wire is somewere between the center of the track and the inside rail of the curve. It is the point at which the trolley shoe rides smoothly without coming off the wire; the point where the trolley shoe or wheel is exactly *tangent* to the wire. Locate this point at each cross span or bracket and secure the ears with a drop of solder. Now push the car along with the pole against the wire and adjust the pull-overs in similar fashion. Put a bead on the pull-over before making the final bend and follow the procedure used for span wires. You may find it necessary to lightly solder the pull-over to the backbone wire to prevent it from sliding out of position. When you have finished your curve, it should appear similar to the illustration in fig. 1. Finish soldering all straight portions of the wire, using the template to locate the wire centerline. If hung on the wire, a small meat skewer or your reverse-tension tweezers will act as a plumb line and speed up your work. Do this to all other ears.

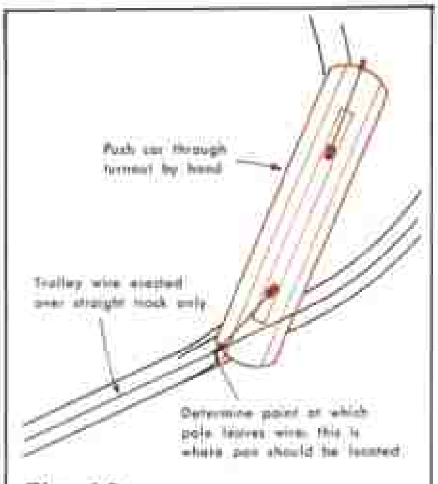


Fig. 10 LOCATING PANS AT TURNOUTS

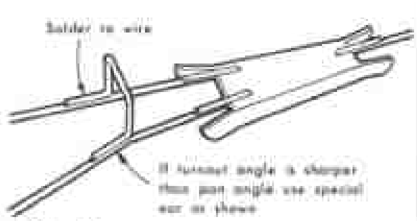


Fig. 11

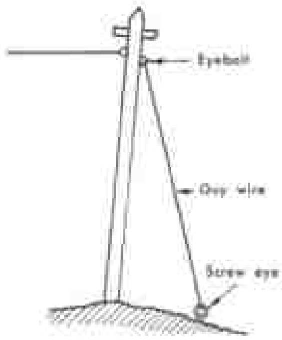


Fig. 12

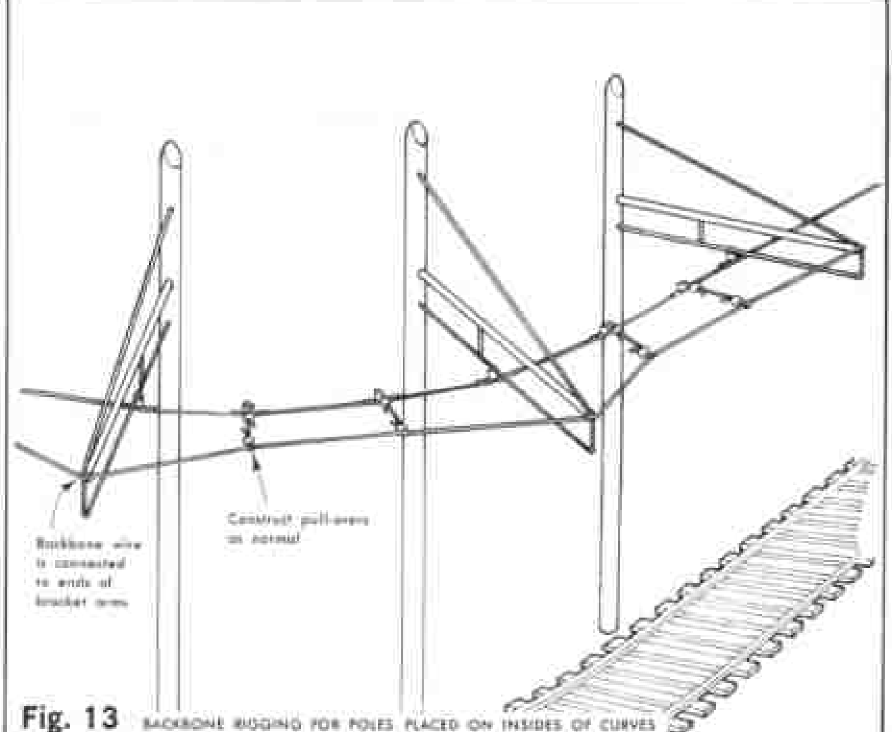


Fig. 13 BACKBONE RIGGING FOR POLES PLACED ON INSIDES OF CURVES

Wire pans

Now you are ready to install the wire pans — the tiny turnouts (also called frogs) placed in the wire over the track switches that enable the pole to follow the correct route. These can be purchased from such suppliers as Suydam and Wagner Car Company.

Here is the easiest way to locate the correct position of a pan: Set a trolley car on the track and push it slowly through the turnout as shown in fig. 10. Mark the point where the pole leaves the wire. If you have several cars, do this with all of them to determine the average point where the poles leave the wire. When you're satisfied that you have the spot, cut the overhead, bend the wire ends upwards and insert the pan. At this point you'll probably discover that the running wire from the diverging route is pulling the pan in that direction, so install a counteracting wire from the opposite side of the pan to the first pole in front of the switch. Tie it into the eyebolt on the pole using the bead construction.

A rule of thumb has been that the wire pan usually is located one-third of the distance between track points and frog. This is usually true, but double-check an actual car before cutting the wire. I have found, too, that this distance is closer to one-fourth of the point-to-frog dimension when using cast pans. Incidentally, if the angle of the turnout happens to be sharper than the angle of the pan, form a special ear as shown in fig. 11 and solder it to the running wires. This will enable the trolley pole to track better.

When hanging wire, don't be afraid to make a mistake the first time around. It is relatively easy to splice together an incorrect cut; just fabricate some small pieces of brass as we did for the wire insulators. Insert one on the splice, cut the double-back ends of the wire short, and touch with the soldering gun.

After all mainline pans have been installed, hang trolley wire over all of your secondary track, yards, sidings, etc. Start from a turnout and work as you did on mainline overhead. Wire on a dead-end siding is tied to a pole at the end of the track as shown at "Yard" in fig. 2.

When you cannot erect poles on the outside of the curve due to natural or man-made obstacles, follow prototype practice by using an extra-long bracket arm and fasten the backbone to the outer ends. You will need to attach a line from the bracket end on the first inside-curve pole to adjacent poles beyond the ends of the curve. This will keep bracket arms in alignment and prevent undue stress on the trolley wire. See fig. 13.

Adjustments

A few more adjustments are in order before we can fully operate. Begin by cleaning off all soldering flux from the overhead with cleaning fluid or lacquer thinner. Pull a car out of the carbarn and give new wirework its crucial test. You may expect a few dewirements at first, but by following these pointers you should be able to correct them:

1. Check for tiny lumps of solder on the wire or ears; remove them with fine sandpaper.

2. Check for trolley wire that is not quite in adjustment on curves; pull-overs may have to be lengthened or shortened. Remember, the trolley wheel should be exactly tangent to the wire.

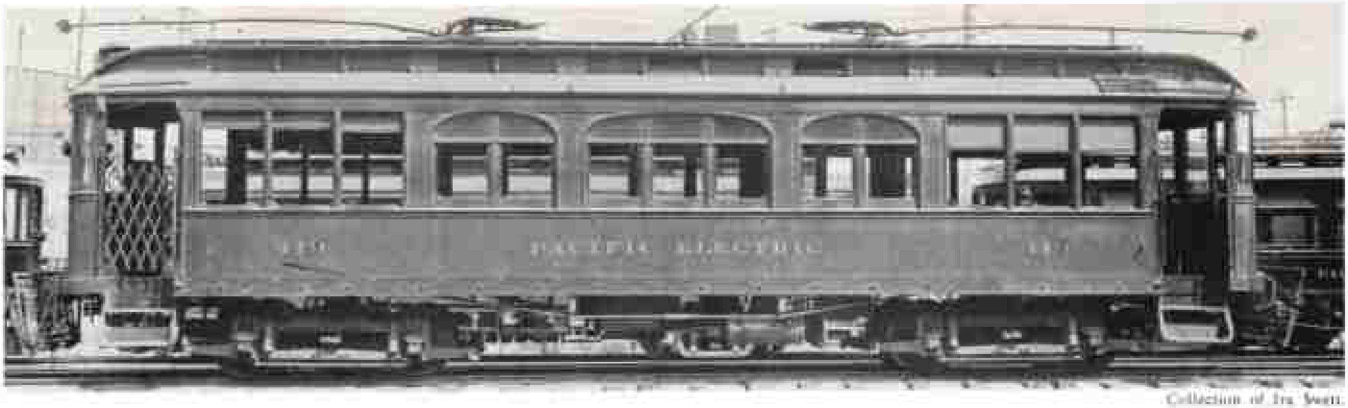
3. If a pole jumps or takes the wrong wire at a turnout, pull the wire a little off center by adjusting or adding pull-overs and backbones. See fig. 1. Moving the turnout off center may also correct this.

4. In the event that the pull of the trolley wire (on curves especially) is enough to bend poles inward, you may have to add a guy wire as shown in fig. 12. This is simply a wire attached to an eyebolt near the top of the pole and anchored to a small screweye in your table-top or framework. Tighten the wire enough to pull the bend out of your pole.

Don't worry if your wire is a tiny bit off center over straight sections of trackage as long as the pole rides smoothly. A leeway of a scale foot each side of center is satisfactory.

For good operation, keep the trolley wire clean with a "Bright Boy" or very fine sandpaper. Also, keep the shoes or wheels on the cars clean. One of the best ways of keeping the wire bright and shiny is by frequent operation. Make at least a franchise run daily and you will never have any trouble.

Happy operating!



Collection of Ira Swett.

■ PROTOTYPE PLANS

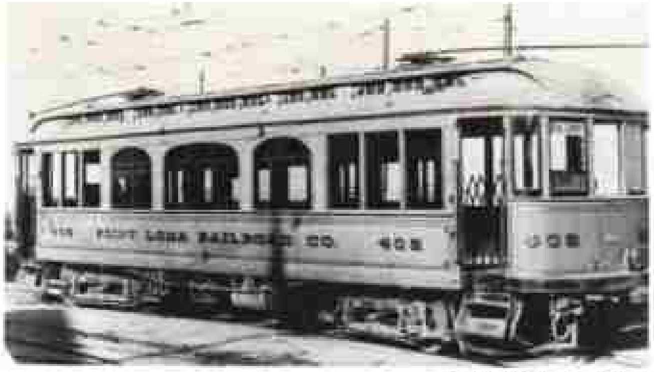
Pacific Electric Niles car

SO-CALLED "California"-type interurban cars had a distinctive open-air seating section at each end and a closed all-weather compartment in the center. In 1908 the Niles (O.) Car Company (a stranger to Southern California) built six such cars, Nos. 105-110, for the newly formed San Diego Southern Railway. The cars differed from other California-pattern cars in two ways. They had the arch windows so characteristic of Niles, and they had wood sheathing below the belt rail at the open sections. Most California-style cars were built with wide-mesh metal grilles beside the seats at the ends.

The cars immediately were put into service between San Diego, Calif., and Chula Vista, a few miles to the south. For a while the route extended to Otay because the track had been laid in 1887 as the National City & Otay Railway, a line originally powered by steam. Steam service was still being maintained to the Mexican border, so this road used both steam and electric power. Later, gas-electric power also was used.

A search for the various lettering schemes used on these cars in subsequent years indicates that many of the small roads in the West Coast cities had overlap-

Arthur R. Alter.



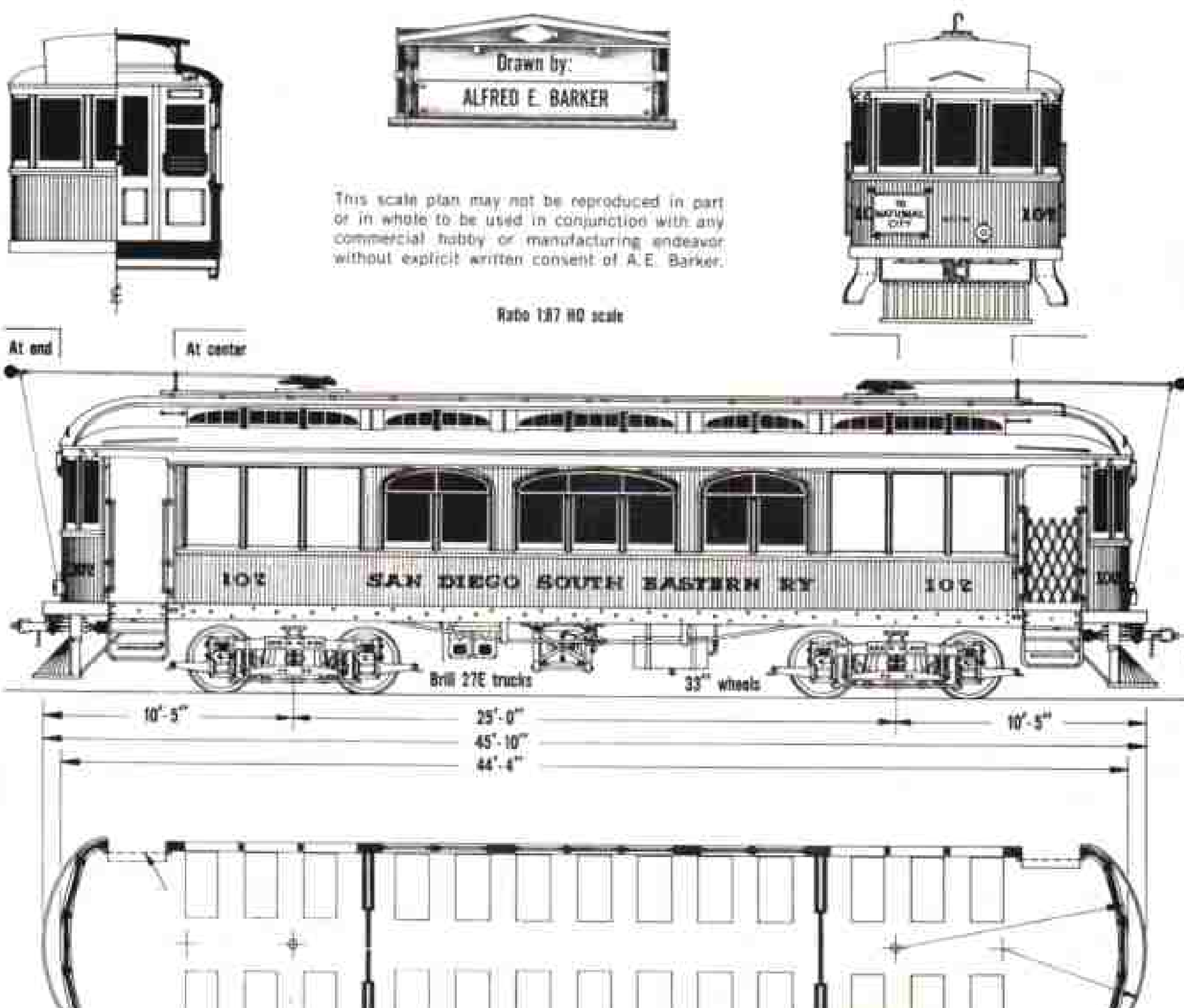
Collection of A. E. Barker

ping managements. Since equipment often was shifted from one road to another, it possibly was re-lettered before a second shift was made.

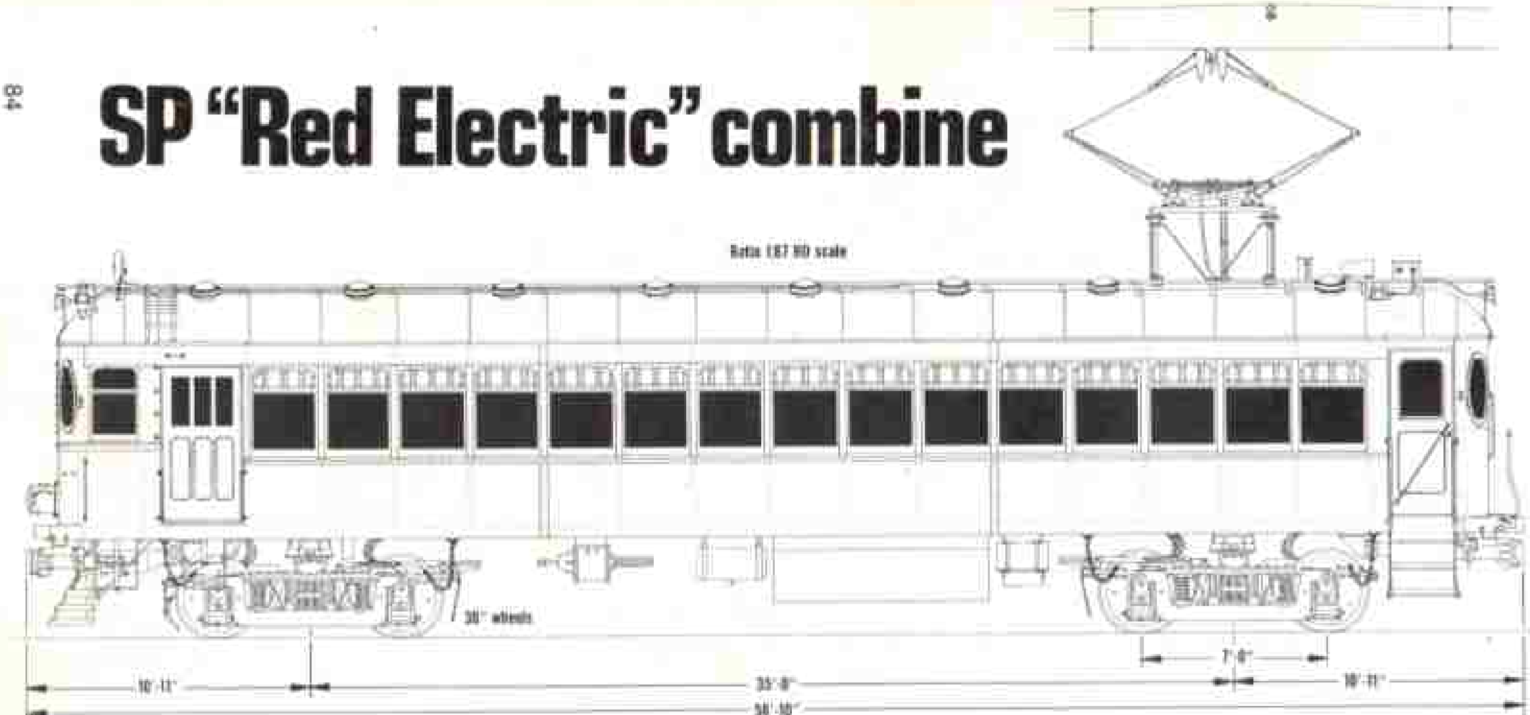
Cars 108 and 109 were transferred to the San Diego Electric Railway Company. They kept their original numbers temporarily but later were renumbered 401 and 402 and lettered POINT LOMA RAILROAD CO. Car 110 may have run the same course, but before its number was changed to 400 it was lettered SAN DIEGO ELECTRIC RAILWAY CO. on the letterboard, while the words SIGHT SEEING CAR were embellished on a panel below the side windows.

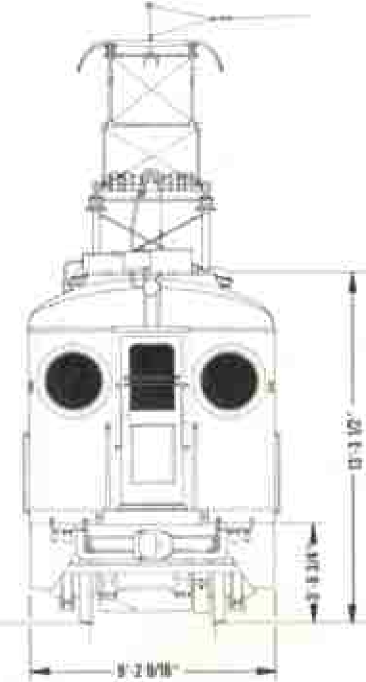
Cars 105-107 stayed as long as they could on their own tracks, but their company name was changed to San Diego South Eastern Railway as shown on the drawing. Great floods washed out much of the SDSE in 1916, so the nearby San Diego & Arizona electrified its tracks; service to Chula Vista was restored on the new owner's route, using the original three cars.

By 1918 the various lines radiating from San Diego needed to be modernized or abandoned. So the six cars were sent to Los Angeles for use on the Pacific Electric. There they were numbered 413-418 (the 400 series was a catchall for odd equipment the PE acquired in small lots from many sources). These were PE's only Niles-built cars. In time, 413 was renumbered 419 and other numbers were probably changed also. One of the cars about to be scrapped as No. 474 in 1934 was needed as an express car so it was rebuilt as car 1300, shown in one of the photos. It ran until 1941.



SP "Red Electric" combine



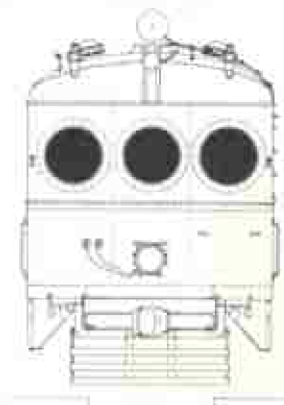


IN 1910 James J. Hill purchased the Oregon Electric Railway, a line that extended south from Portland through the east side of the rich Willamette Valley to Eugene, Ore., via Salem. Hill envisioned extension of the line all the way to the Sacramento Northern in California, thereby forming an all-electric transcoastal route.

Hill's purchase of the OE prompted the Harriman-controlled Southern Pacific to electrify its Portland-Eugene (via Corvallis) line which operated through the west side of the Willamette Valley. By 1920 SP had electrified as far south as Corvallis, but the wires never did reach Eugene.

SP began its electrification program in 1912 by acquiring the Portland, Eugene & Eastern, which operated street railways in Eugene, Salem, and Albany. SP electric operation out of Portland began in 1914 under the PE&E banner. Service was provided by a fleet of handsome Pullman-built cars. SP's owl-eyed electric cars were painted bright red (eventually all equipment was lettered for Southern Pacific), and the cars soon earned the nickname "Red Electrics." The roster of ex-PE&E cars, the subject of the drawing, included 17 single-ended combines, Nos. 500-516, built by Pullman in 1912. They were among the earliest all-steel interurbans built.

When Southern Pacific ended its electric passenger operations in Oregon in 1929, most of the passenger equipment migrated south to operate on SP's highly successful Pacific Electric system in Los Angeles. The 17 combines went to PE, but only five — Nos. 501, and 511-514 (renumbered to PE 1374, 1375, 1376, 1372, and 1373 respectively) — were converted by PE for operation on their system; they scrapped the rest.



University of Oregon Library

Drawn by:
ALFRED E. BARKER

South Shore Line steel coach

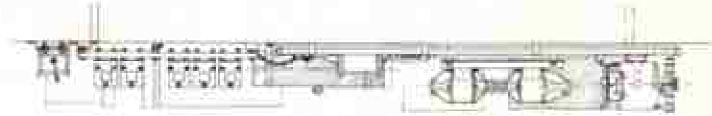
Drawn by:
CARLTON L. RICHARDSON

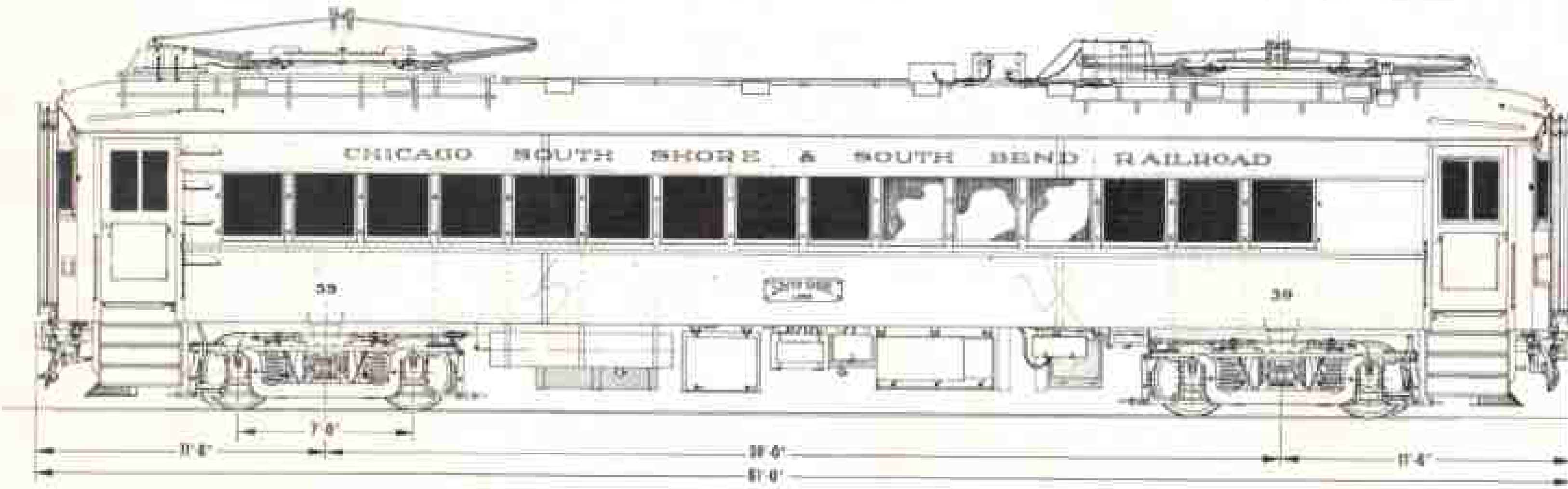
MAINSTAY of Chicago South Shore & South Bend's passenger-train fleet were 69 heavy steel interurban cars built in the 1920's by Pullman Car & Manufacturing Corporation and the Standard Steel Car Company. These included powered coaches and combines; and coach, parlor, and diner trailers.

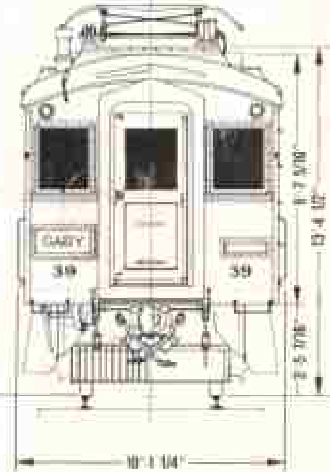
The plans shown are for CSS&SB powered coaches Nos. 16-25 (Pullman 1927) and Nos. 10, 26-39 (Standard 1929). These cars seated 40 in the coach section and 8 in a small enclosed "Pullman" smoking compartment. With slight alterations, the plans also may be used to model the nearly identical Pullman-built South Shore coaches of 1926, Nos. 1-9 and 11-15. These contained walk-through smoking sections and had platforms that were 6 inches shorter than those on Standard Steel cars.

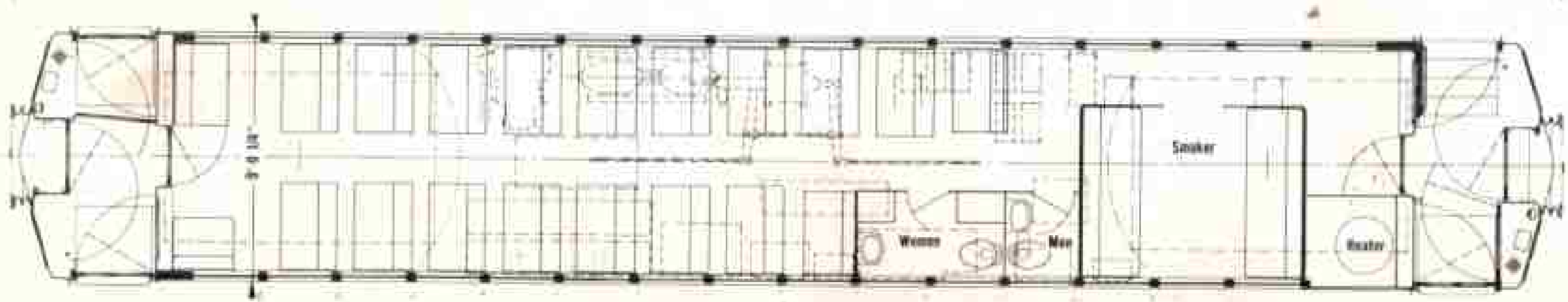
The Pullman and the Standard cars were among the heaviest and fastest interurbans ever built, serving on South Shore Line trains between Chicago, Gary, Michigan City, and South Bend. All but a few of the orange-and-maroon cars survived into the 1970's, although many were rebuilt, lengthened, and modernized after World War II.

P. Stager









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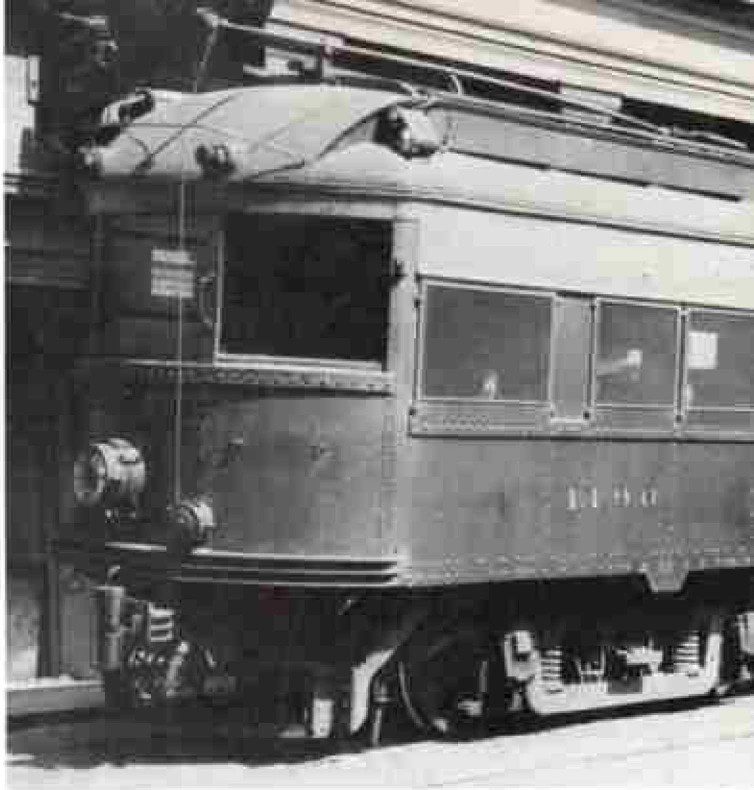
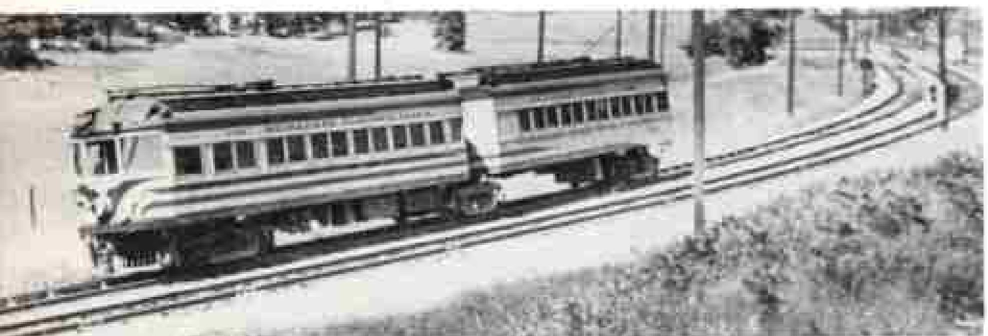


TRAINS: Wallace W. Abbey

Milwaukee duplex interurbans

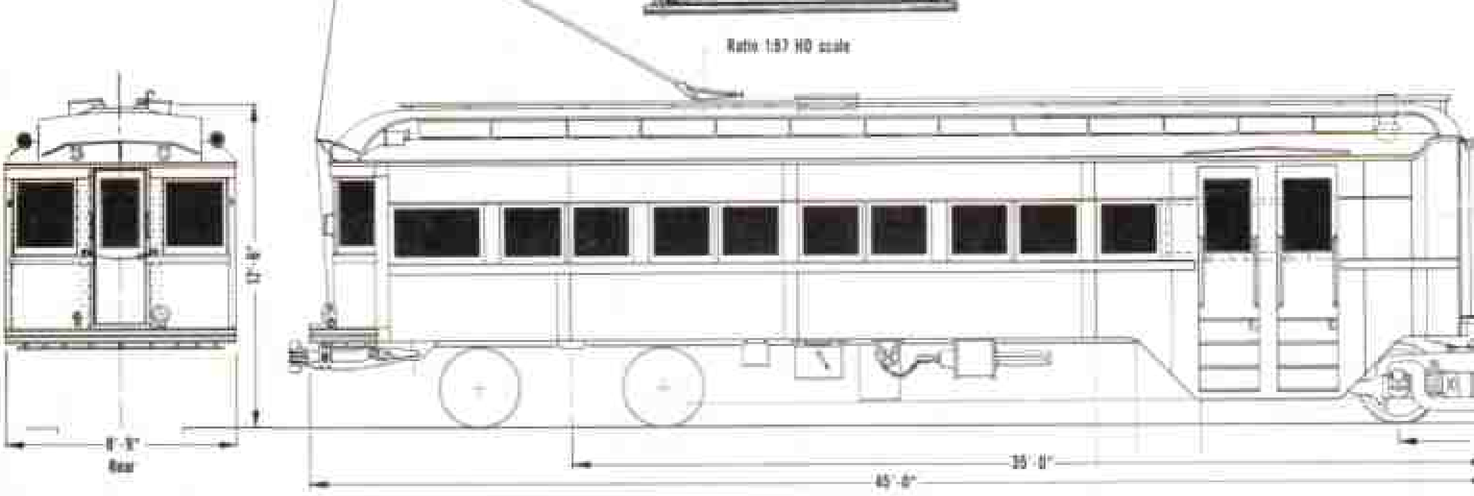


William D. Middleton

MILWAUKEE ELECTRIC'S eight duplex interurbans were rebuilt from single cars bought in 1929 from Indianapolis & Cincinnati Traction. They weighed 66 tons and seated 84 passengers. The end trucks were Baldwin 84-30-AA (each with two GE-254 140-h.p. motors); the center truck was a Standard C-80-P (without motors). The original paint scheme was Pullman green with a yellow letterboard and a black roof and underbody. The post-World War II striped livery was green and yellow with black lettering. The eight sets of cars were dual numbered, 1180-1181 through 1194-1195 (rear cars bore odd numbers). They often ran with single cars during rush-hour traffic. TMER&L (The Milwaukee Electric Railway & Light Co.) also owned two articulated diner-coaches.

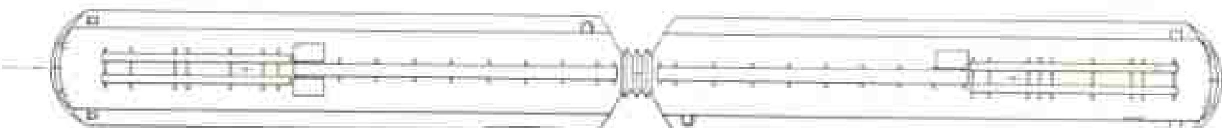
Drawn by:
GORDON ODEGARD
GEORGE A. GLOFF

Ratio 1:87 HO scale

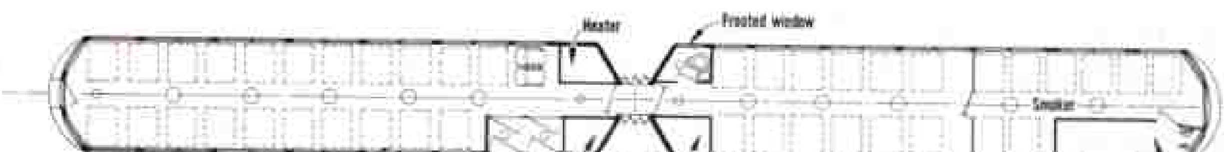


Harvey Arendt

John Hokar

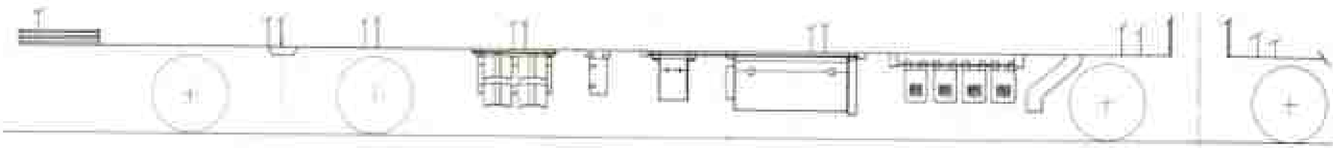


Roof plan

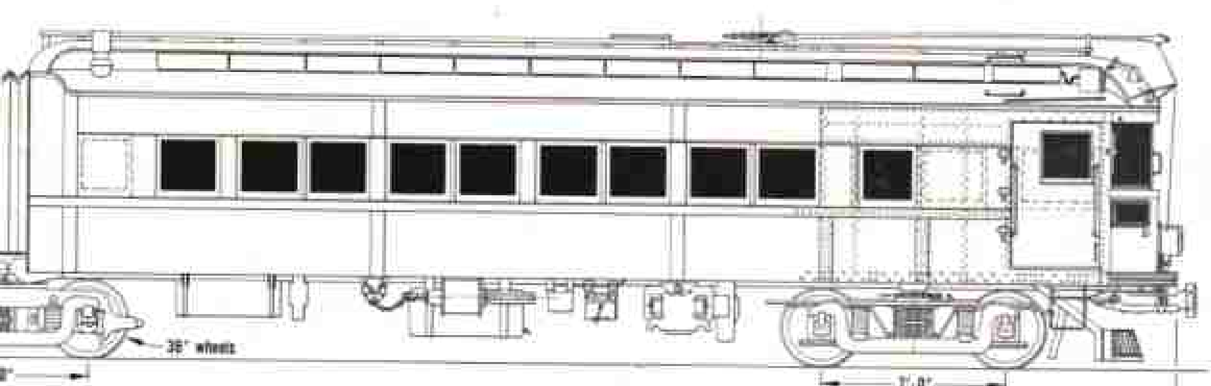


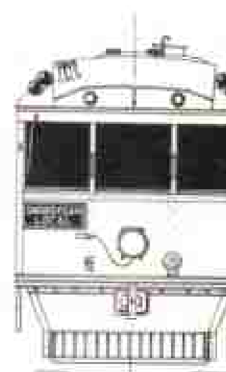
Floor plan

Ratio 1:174 1/2 HO scale



Left side of front unit





Front

All-steel freight motors from C&LE

THE Cincinnati & Lake Erie looked most promising in the early 1930's even though it comprised several interurban lines that previously had failed. The newly merged 270-mile system ran from the outskirts of Cincinnati, O., to Toledo (with through connections to Detroit) with a line east to Springfield and Columbus. These cities, along with Dayton, Lima, and others, were considered strong traffic centers. The system was carefully studied by its organizer, Dr. Thomas Conway Jr., who had faith in interurbans for medium-distance transport and who had already gained experience by revitalizing the Chicago Aurora & Elgin. Conway put fast passenger cars on the C&LE and even had one photographed racing an airplane. He also ordered 15 all-steel interurban freight motors. They came from the Cincinnati Car Co. in 1930 and were numbered 635 to 649.

The venture was bold and received good publicity, especially from hopeful railfans who felt all other interurbans should follow the same path to success. But the path didn't lead there. The C&LE failed and title to the freight motors went to the Railway Accessories Co. in Cincinnati. This firm sold them to the following new owners:

Cars 635, 636, and 638 became 9, 8, and 10 on the Central California Traction Co.

Cars 637, 639, 640, 645, 646, 647, and 649 kept their numbers and went to the American Aggregates Corp. in Greenville, O.

Cars 641 and 648 presumably went to the Tulsa-Sapulpa Union.

Cars 642, 643, and 644 became 601, 602, and 603 on the Illinois Terminal.

The CCT cars were rebuilt into locomotives by substituting new trucks (Brill 27-MBC-3X) and control equipment. Pantographs and third-rail shoes of the underrunning type also were added. The pantographs came from Southern Pacific cars when they were sent from Oakland to be used on the Pacific Electric.

The cars that went to Greenville were converted into diesel locomotives using their original Taylor trucks. The IT cars were rebuilt as freight trailers; trucks were substituted and train doors added. A photo on this page shows baggage-trailer 603 in tow behind an IT passenger motor.

The drawing shows the C&LE car as rebuilt for the CCT. The CCT cars were yellow with red letterboards and black roof and underbody; silver diagonal stripes graced the ends. When the line was dieselized in 1947 the cars were sent to Pacific Electric. On the way, Nos. 8 and 10 were so badly damaged in an accident that they were considered unusable. All three were scrapped in PE's Torrance shops.

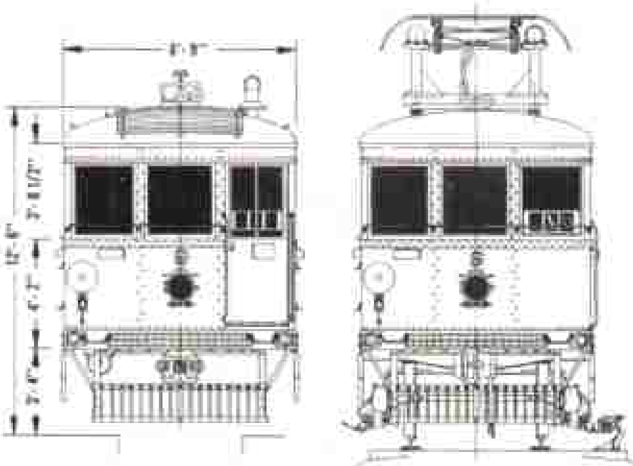
Fred H. Matthews Jr.

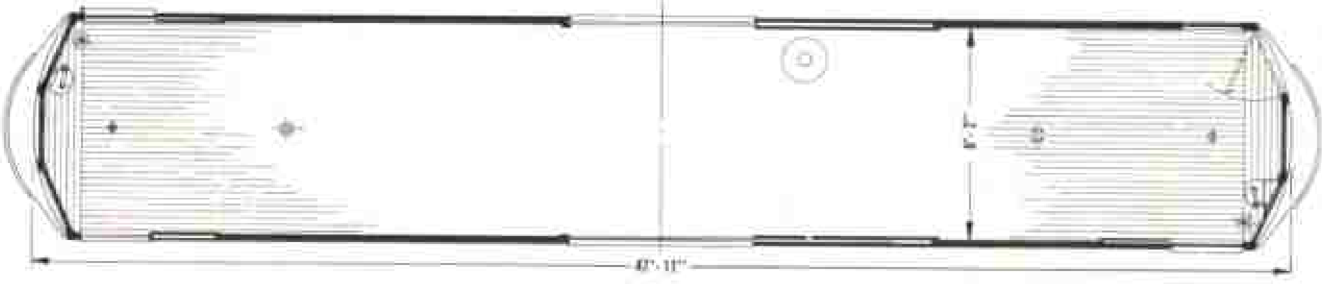
Barney Neuberger

Drawn by:

ALFRED E. BARKER

Alfred Hay





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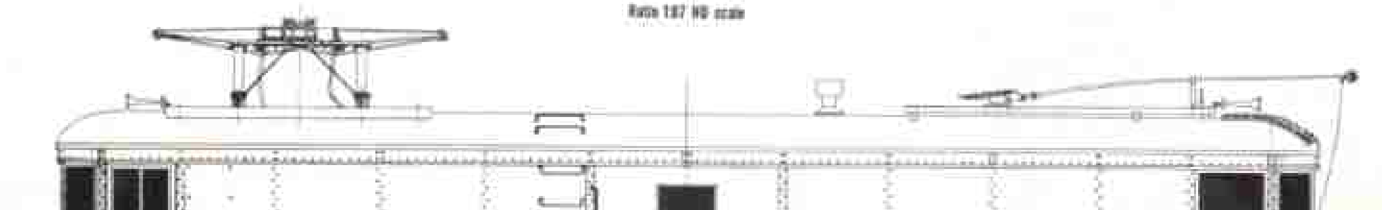
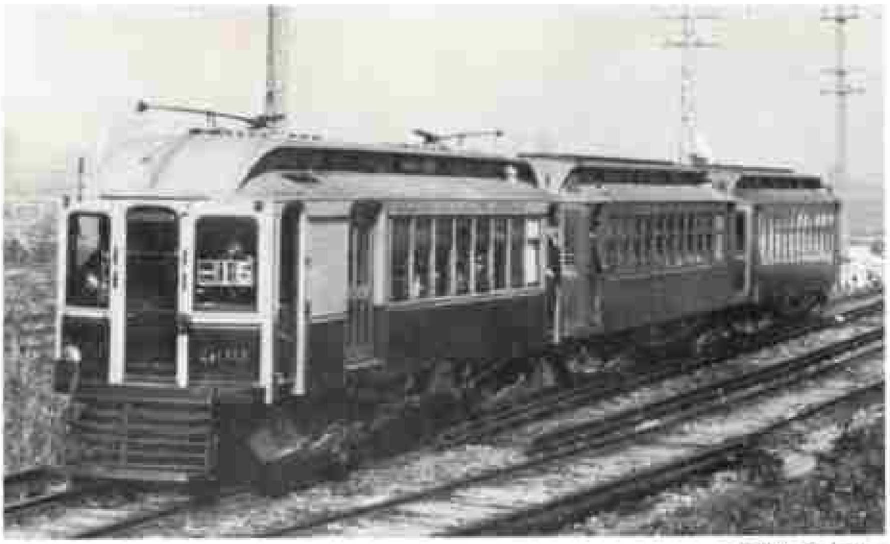
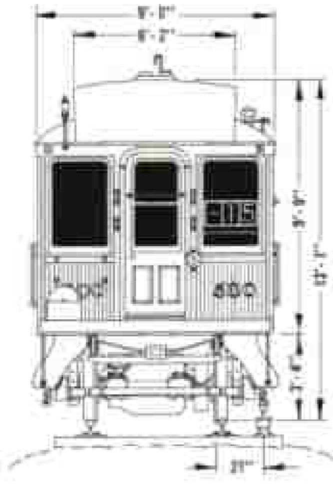




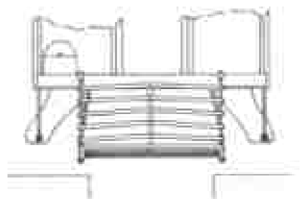
William C. Janssen



Seattle-Tacoma Interurban Railway combine

Drawn by:
ALFRED E. BARKER

THE 500-509 series of cars delivered to the Seattle-Tacoma Interurban Railway in 1902 included five combine motors (500, 502, 504, 506, 508), two passenger motors (501, 503), and three trailers (505, 507, 509). They represented the J. G. Brill Company's effort to produce a pleasing style of car for interurban and suburban service. The photo shows No. 500 in a new paint scheme and lettered for the Puget Sound Electric Railway, a name resulting from a reorganization in December 1902. The other cars apparently have the original color scheme. All of the cars carry overrunning thirdrail shoes, but only No. 500 in this photo is equipped with a trolley for city street running, so the trio must always have run as a train.



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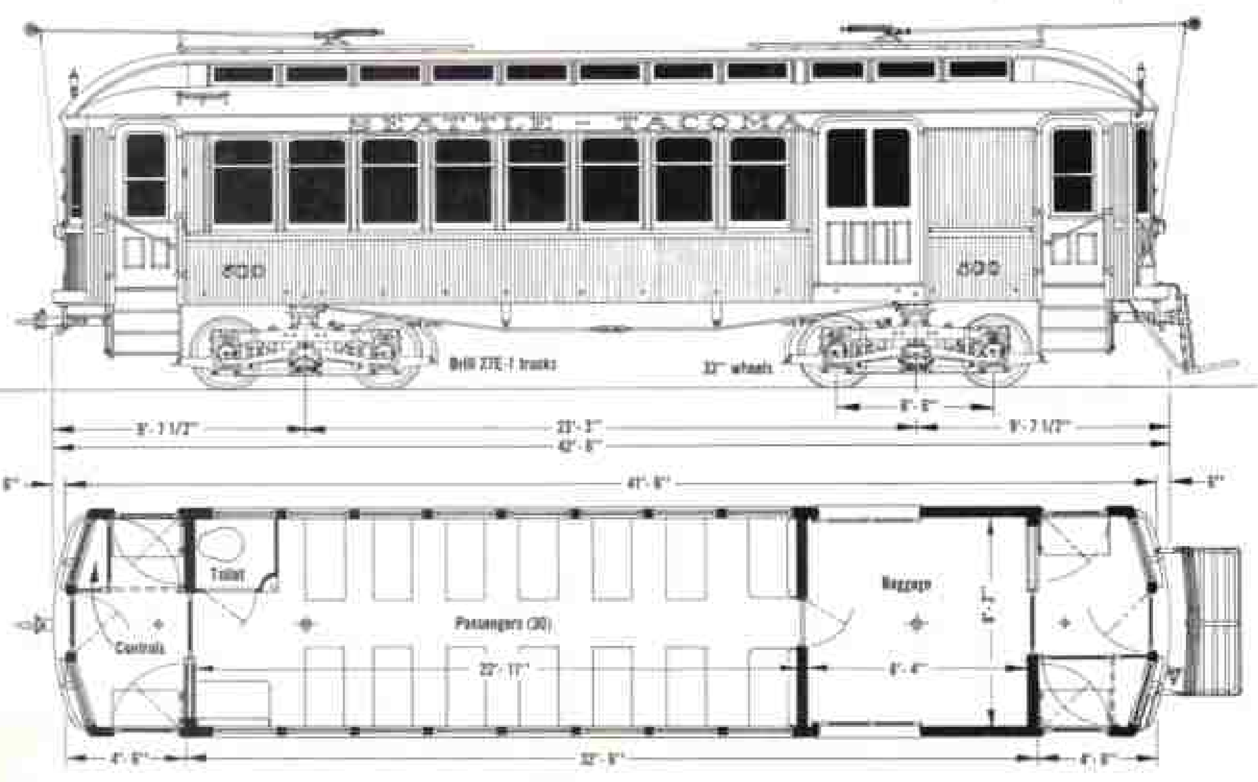
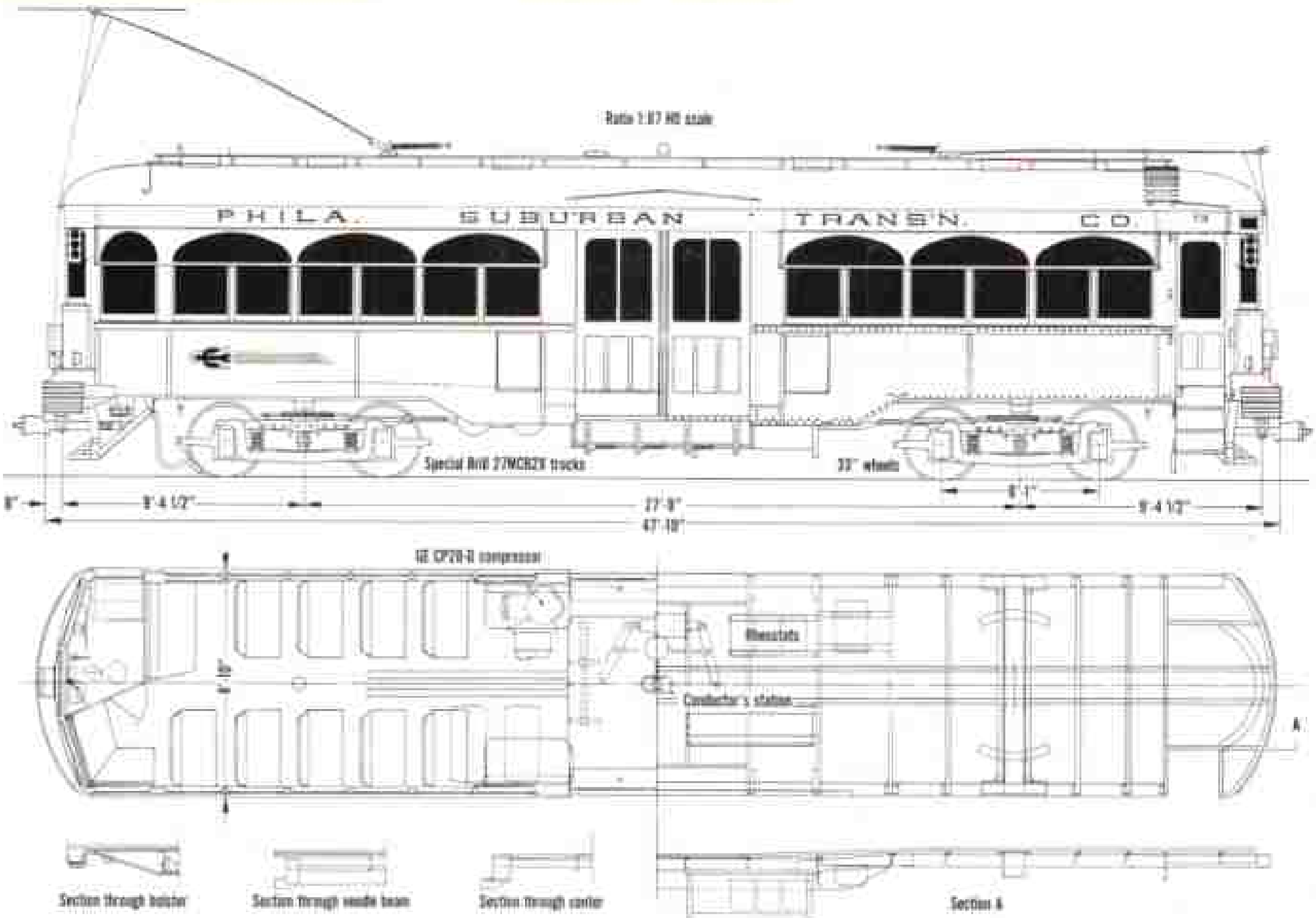
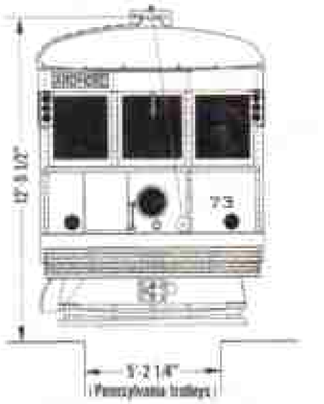




William Crawford



Drawn by:
DAVID E. CRAWFORD

PST side-door interurban

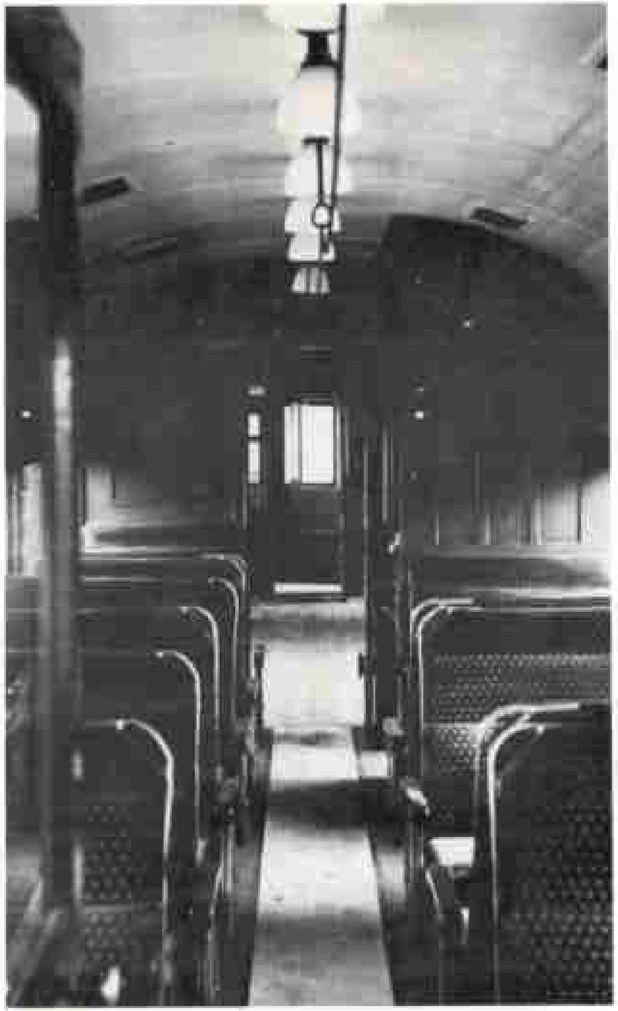
THE Philadelphia Suburban Transportation Company, now operating under the Southeastern Pennsylvania Transportation Authority (SEPTA), is one of the few remaining electric railway operators in the United States. The system includes the standard-gauge third-rail Norristown line of the old Philadelphia & Western Railway and the 5-foot 2¼-inch-gauge Ardmore, Media, and Sharon Hill lines of the old Philadelphia & West Chester Traction Company.

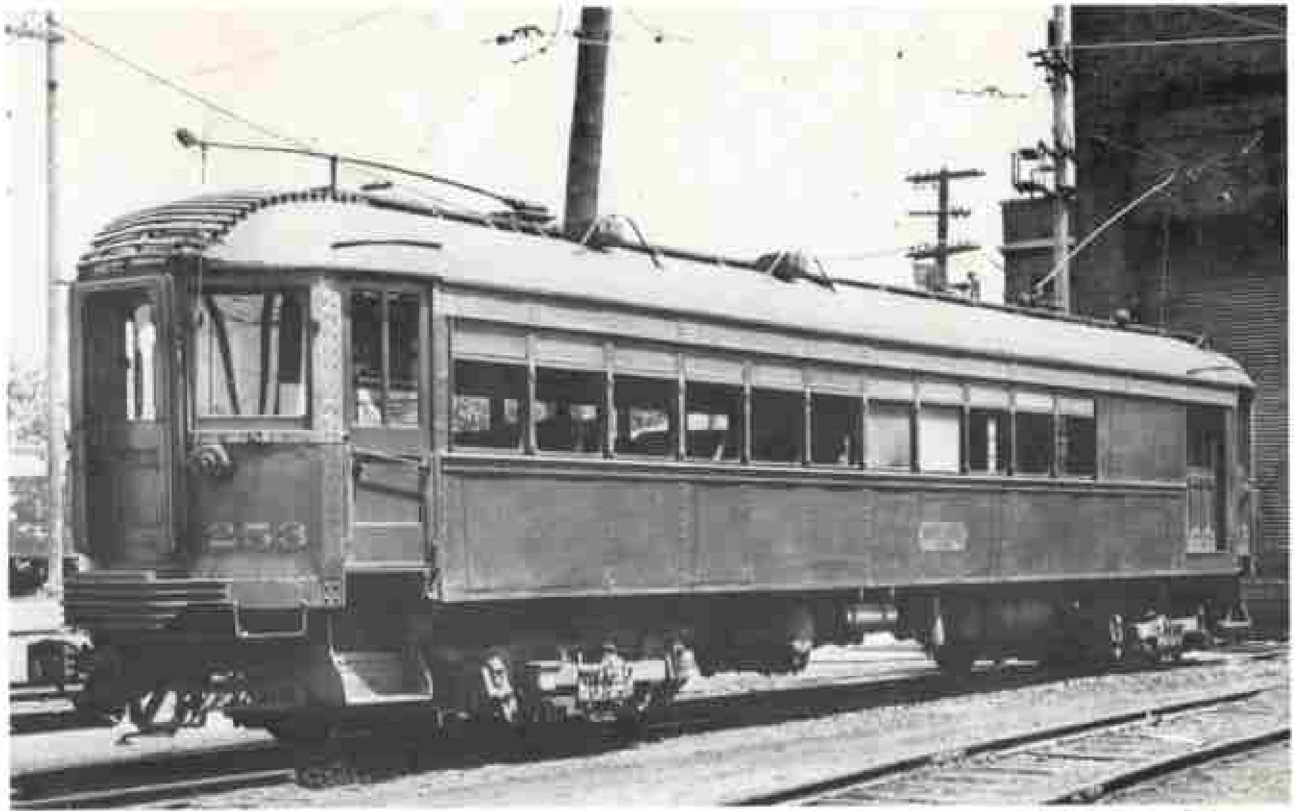
Thirty-two of these center-entrance cars were built by J. G. Brill in 1919, 1925, and 1926. They were nicknamed "side-door" cars. In 1932 Brill proposed rebuilding, but 10 lightweight cars were built instead. An extra anticlimber was added to the older cars to meet those of the new cars. Ten "Brilliners" were added to the fleet in 1941, and all the cars were updated with flashing-red fog lights. The simple red paint scheme gave way to a four-color livery after 14 St. Louis Car Company quasi-PCC cars arrived in 1949.

The trucks of the side-door cars are unusual in that they have a curved equalizer. Modelers could alter commercial truck sides to match this style.

The drawing shows the rivet detail on one end only. The pattern on the other end is similar. The marker lights have red, green, and white lenses, from top to bottom. These are a rare type and the only other cars known to have them are gas-electrics that ran on lines around Louisville. Between two cars of the train, the lights show red. The front of the first car shows green lights and the rear car shows red. The white lights were for extras, but were seldom used. Red lights on the front of a car indicate a second section following.

The drawing represents Nos. 65-76. Nos. 55-64 are nearly identical, but Nos. 45-54 differed in length by 7", used different markers, and had a level floor line.





Both photos, Catenary Productions.

North Shore Line combine

THE seven cars of the 250-256 series were the only steel passenger-baggage cars on the Chicago North Shore & Milwaukee Railway. They were built in 1917 by Jewett and were powered by four Westinghouse 557A5 motors geared 23:52 mounted on Baldwin 84-30A trucks. Control was provided by Westinghouse WH28A master controllers. The cars weighed 91,000 pounds and originally seated 40 passengers.

The small baggage compartment proved inadequate in Chicago-Milwaukee service. Between 1924 and 1927 the baggage compartments were lengthened by two windows and seating reduced to 28 passengers. The drawing shows No. 253 with this arrangement in the 1940's. No. 255 had all its seats removed, then replaced, then removed again in 1946 in order to carry sailors' baggage to and from the Great Lakes Naval Training Center at North Chicago, Ill.

The original color scheme of these cars was: body, coach green; roof, brown; lettering, gold; monogram, gold on green.

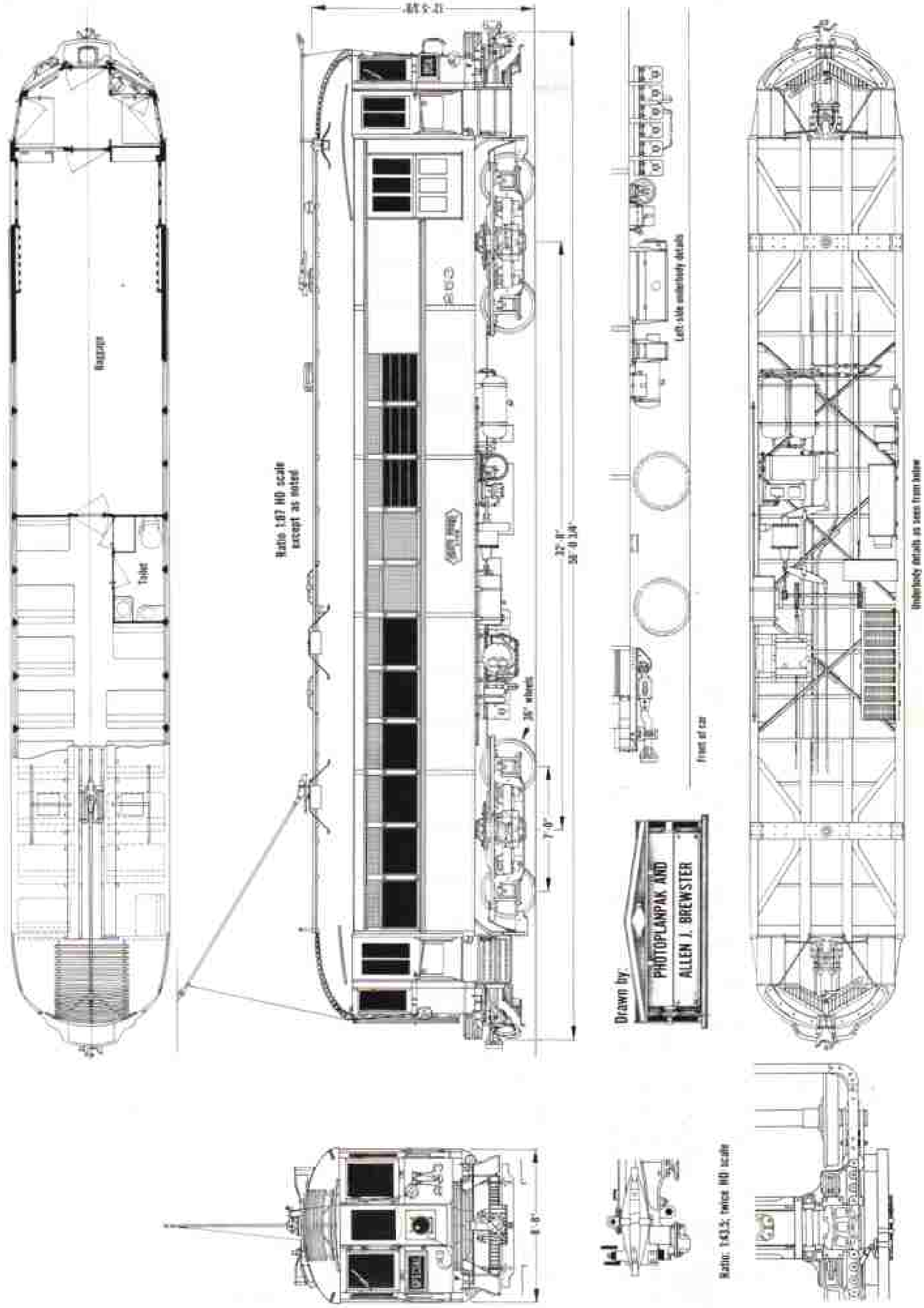
In 1927 the cars were repainted: body, orange; roof, brown; lettering, gold with black outline; monogram, gold on maroon background. In 1938 bodies were repainted dark green; sash strips, light green; a 5-inch strip at body skirt, red; roof, light gray; lettering, gold; monogram, gold on red.

From 1948 until the cars were retired in 1963 the colors were: body, medium green; letterboard, red with no lettering, doors and front window posts, red; roof, dark gray; lettering, gold; monogram, gold on red.

Car 251 was given the red-and-silver "Silverliner" color scheme in later years. Lettering was silver with black outline; the cast monogram was silver with red background. In all cases the underbody was black.

The North Shore Line ceased operations in 1963. Nos. 252, 254, 255, and 256 were scrapped in 1963 and 1964. No. 250 is preserved at the Indiana Railway Museum at Westport, Ind. No. 251 (in its "Silverliner" colors) and No. 253 are at the Illinois Railway Museum, Union, Ill.

Information came from: Don Olsen, who also furnished part of the drawing; the North Shore Technical Information Group; Central Electric Railfan Association *Bulletin* No. 106; and William J. Clouser, noted model builder of St. Louis, Mo.



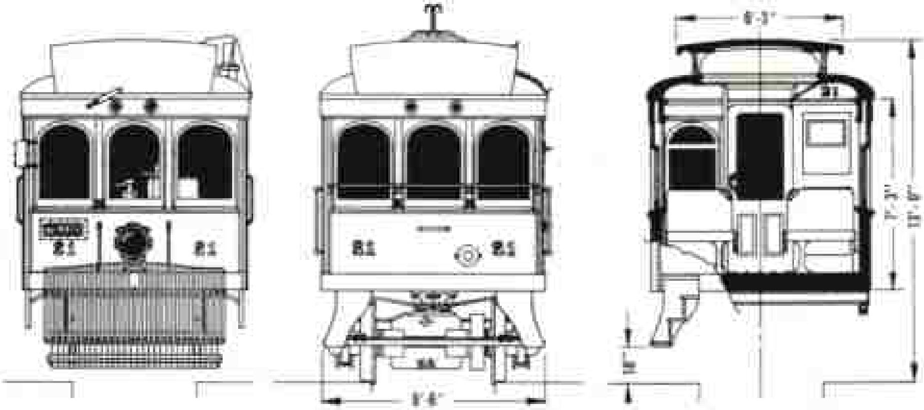
Baggage
Toilet
Ratio 1:87 HO scale
except as noted
36" wheels
7' 0"
Left side underbody details
Front of car
Drawn by:
PHOTOPLANPAK AND
ALLEN J. BREWSTER
Underbody details as seen from below
8' 6"
Ratio 1:43.5; twice HO scale

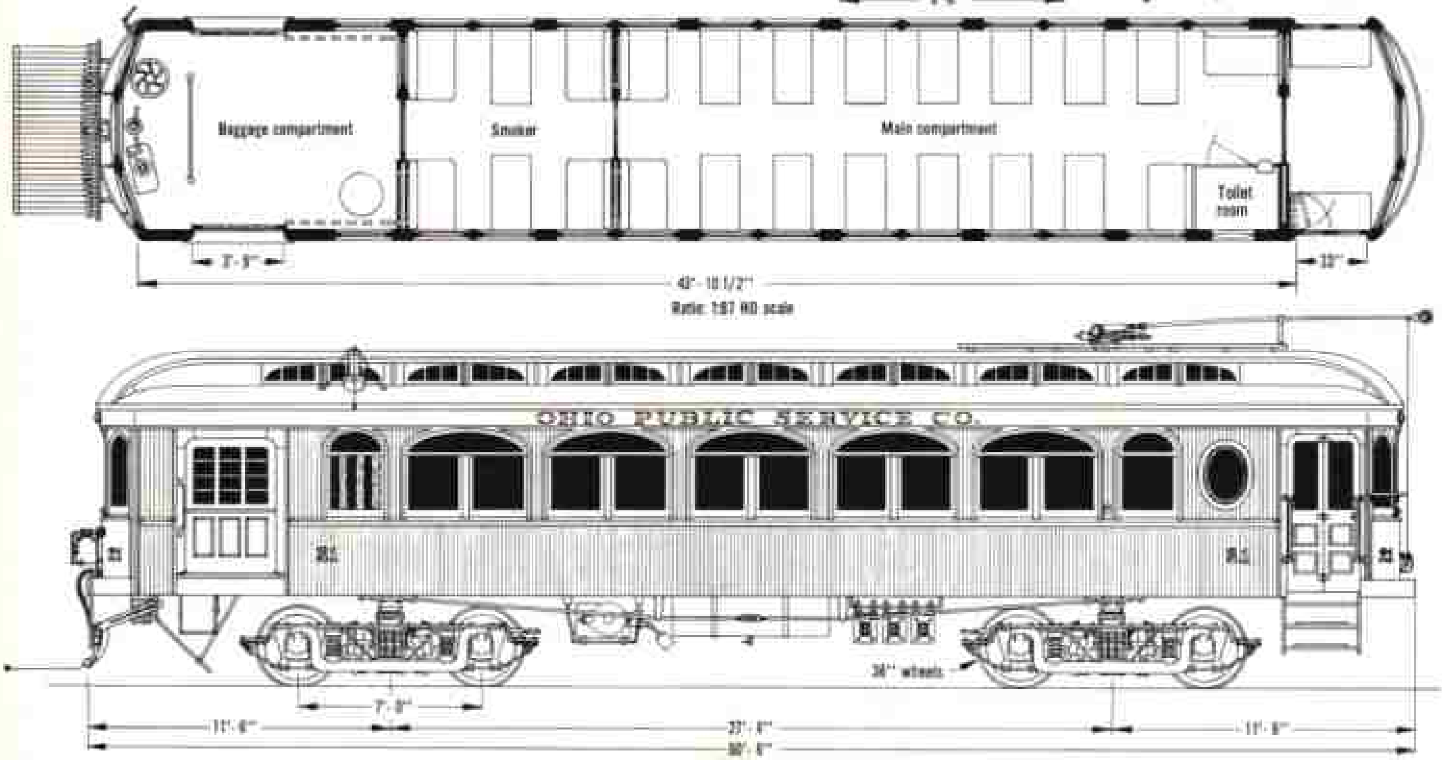
Dave Bunge, courtesy Ohio Railway Museum

Ohio Public Service combine

Drawn by:
ALFRED E. BARKER

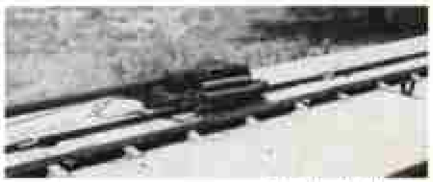
OHIO PUBLIC SERVICE COMPANY'S interurban operation was the former Toledo, Port Clinton & Lakeside Railway, which ran from Toledo through Port Clinton to Marblehead on the Marblehead Peninsula in northern Ohio. A short line from Marblehead to Bay Point made connections with lake steamers to Cedar Point resort and Sandusky until 1925. The TPC&L-OPS was one of the longest-lived interurbans, operating until 1945. Parts of the line lasted until 1958 as the Toledo & Eastern. Car 21, a big Niles combine, is at the Ohio Railway Museum at Worthington. The plan shows her as originally built with a fender; the wood pilot in the photo came later.





Lotis Bass

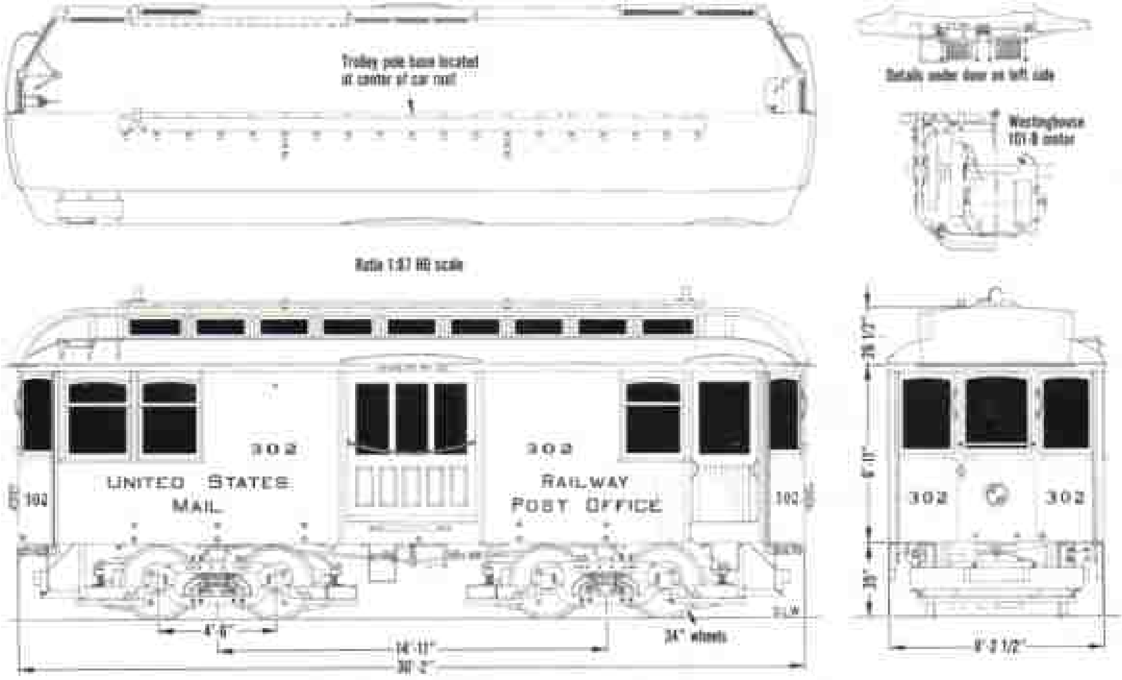
RPO interurban



David L. Waddington

THIS interesting little Railway Post Office car was once owned by the Union Street Railway of New Bedford, Mass., but it is now a part of the trolley museum of the Branford Electric Railway Association near New Haven, Conn. The car was built as an express trailer, was converted to snowplow use, and finally was remodeled for RPO service. The 30-foot car was used in double-daily interurban service between Fall River, Mass., and New Bedford, Onset, and Wareham, Mass., until about 1930.

Drawn by:
DAVID L. WADDINGTON

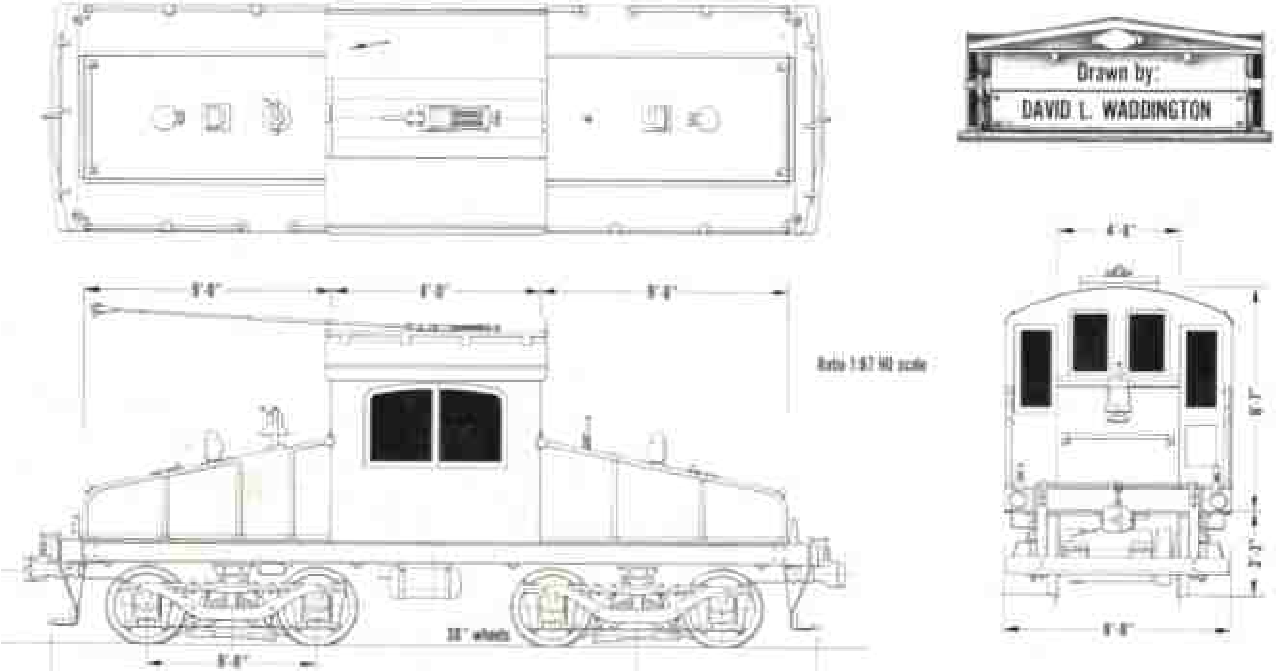


Collection of David L. Waddington.

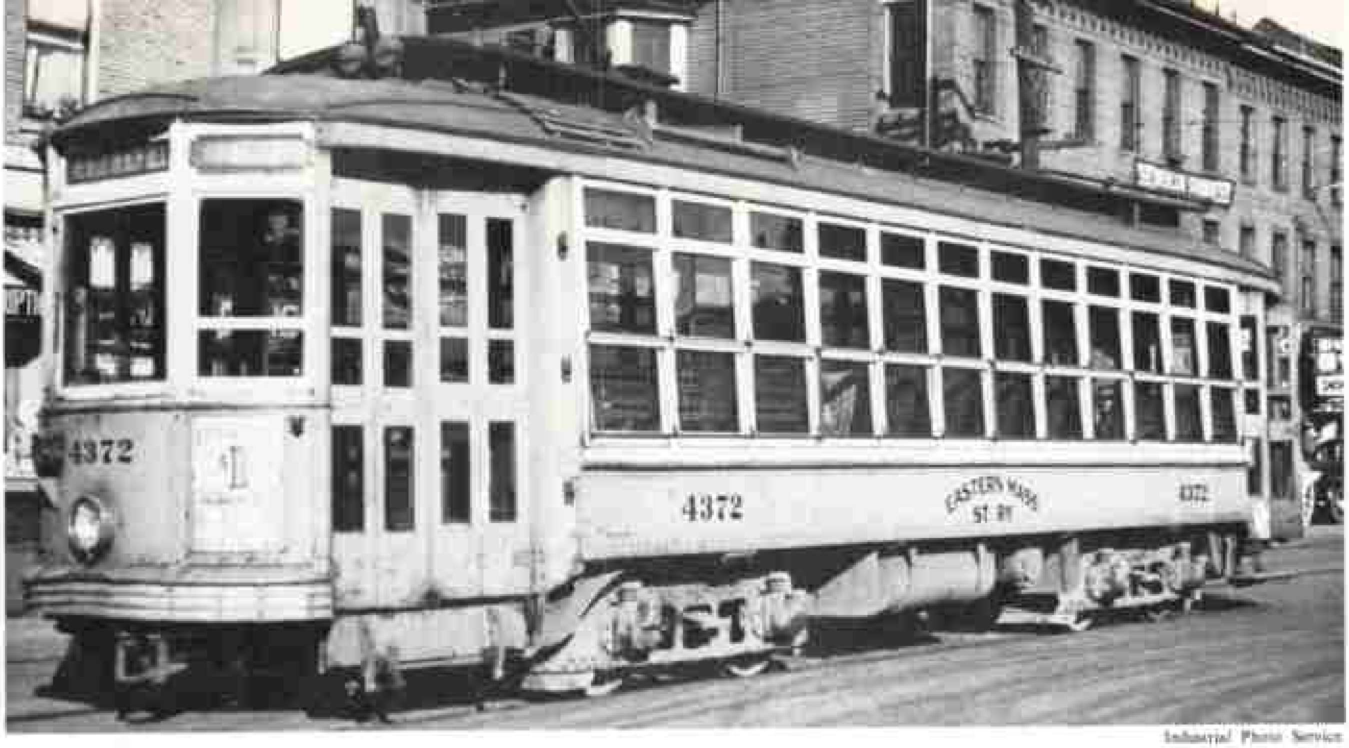
General Electric steeplecab

WHEN the interurbans first were developing their freight business, they used converted passenger equipment, perhaps geared down and ballasted for more tractive effort at lower speed. Recognizing the need and the potential market for more efficient power for this work, both General Electric and Westinghouse introduced lines of light electric locomotives in the 25- to 30-ton, 40-ton, and 50- to 60-ton sizes. The GE design is illustrated here with locomotives of varying tonnages. The drawing shows the 40-ton size.

The mechanical parts for these little freight haulers were designed and built by American Locomotive Company, just as Baldwin built the basic body and trucks for Westinghouse. The Alco influence is immediately evident to the motive power connoisseur in the cab design, with its arched side windows. When GE moved its Locomotive & Car Equipment Department from Schenectady, N.Y., to Erie, Pa., it also began to design and build its own mechanical components. GE steeplecab locomotives of this later era are distinguished by their squared-up cab windows and slightly boxier cab and hood design. They were built in sizes up to 85 tons.



All photos this page, Industrial Photo Service

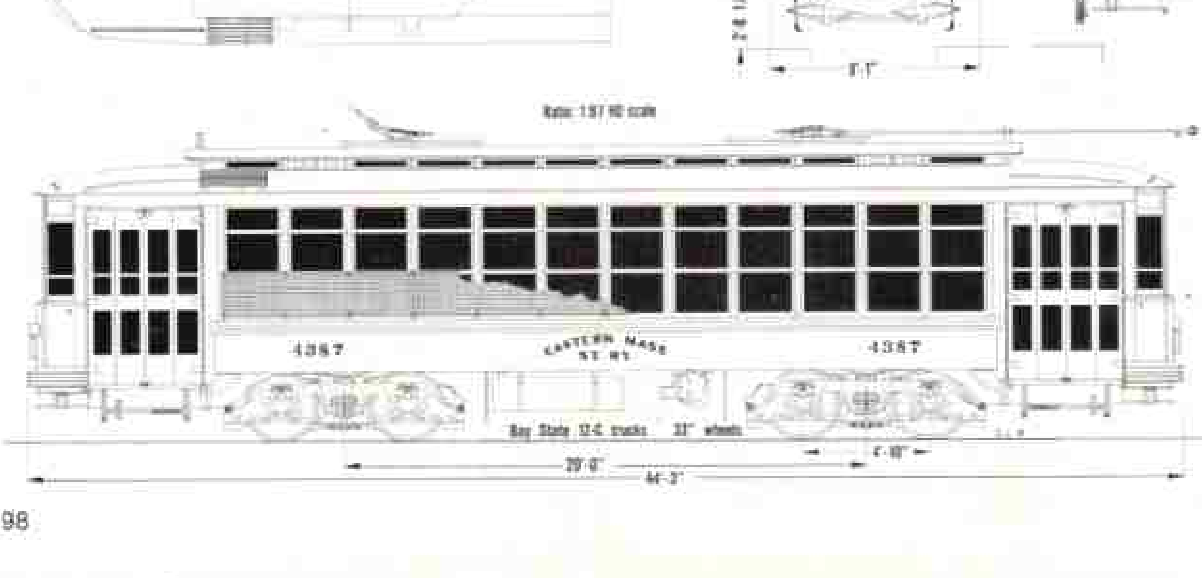


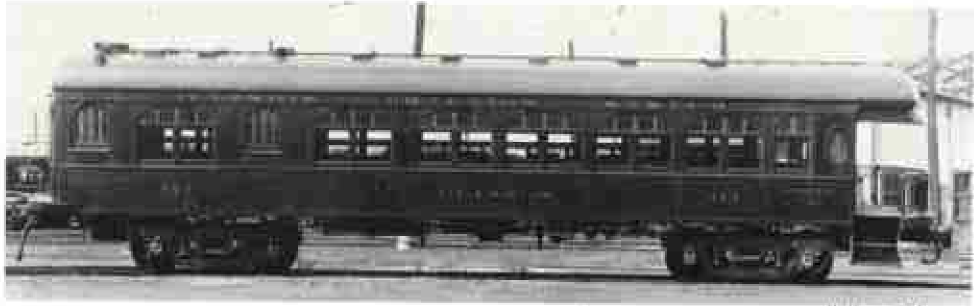
Industrial Photo Service

Eastern Massachusetts semi-convertible car

EASTERN MASSACHUSETTS No. 4372 is a semi-convertible car, with window frames that slide up into the roof for summer service. This was one of 100 semi-convertible cars built by Laconia (N. H.) Car Company in 1917-1918. Colors included orange on the sides, doors, ends, and letterboards; cream on the sash and belt rail; gray on the roof; black on the underbody; and aluminum on the anti-climber.

Drawn by:
DAVID L. WADDINGTON





William C. Janssen

LUXURIOUS elegance in the Midwest during the interurban era reached a peak with the five parlor-observation cars placed in service in 1910 by the Illinois Traction System on its St. Louis (Mo.) main line.

The cars were built by the Danville (Ill.) Car Company as trailers. Original colors were Brewster green body, mahogany (later maroon) sash, terra cotta (reddish brown) roof, and gold-leaf lettering. Trucks and fittings were black. Around 1928, when matching combines were regeared for higher speed, the front trucks of these cars were replaced by powered trucks. The color scheme was changed to tangerine, and the railroad's new name was lettered in black: ILLINOIS TERMINAL R.R. SYSTEM. In 1936, four cars were air-conditioned; they lost their arch windows and had their rear platforms enclosed. No. 512, *Cerro Gordo*, was repainted blue with light-gray roof and sash, and white lettering to match IT's new streamliners that arrived in 1949.

No. 514, *Lincoln*, was depowered in 1935 and later served, until the end of IT electrification, in maintenance-of-way service. The other four cars were scrapped in the early 1950's.

ITS parlor-observation car

Drawn by:
ALFRED E. BARKER

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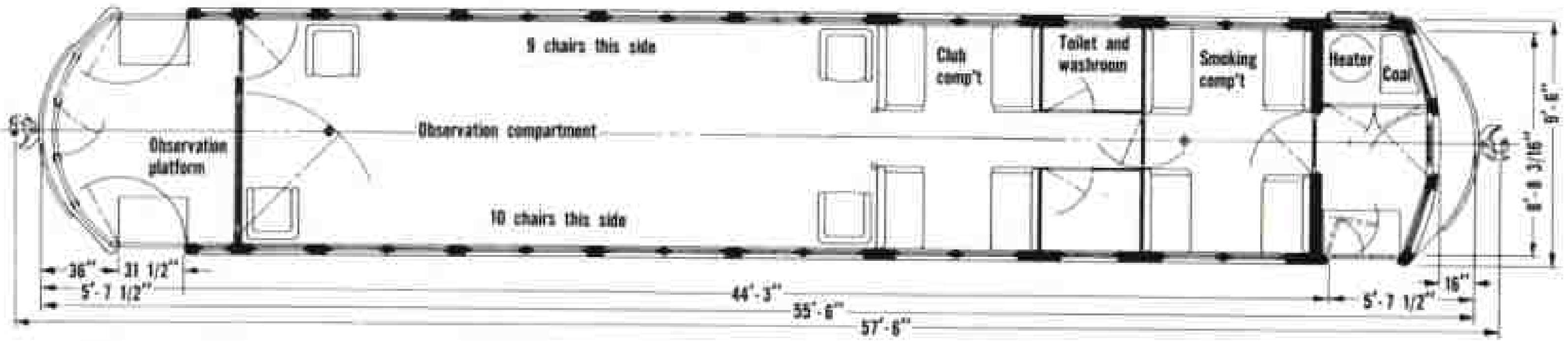

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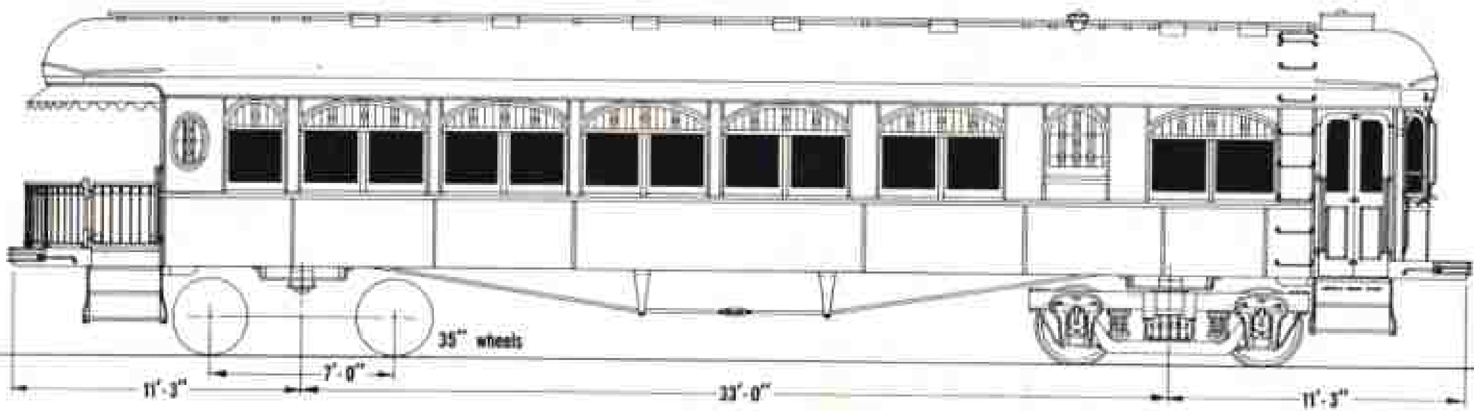
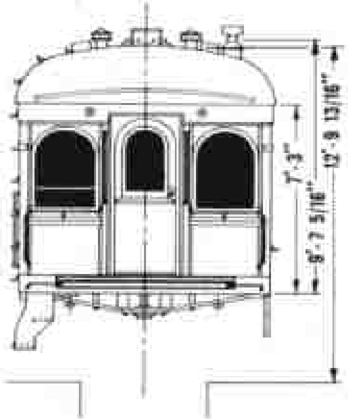


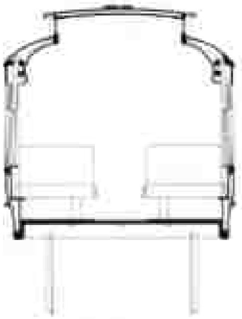


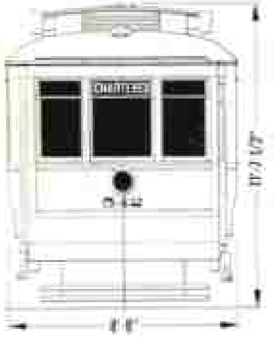
Chicago Surface Lines streetcar

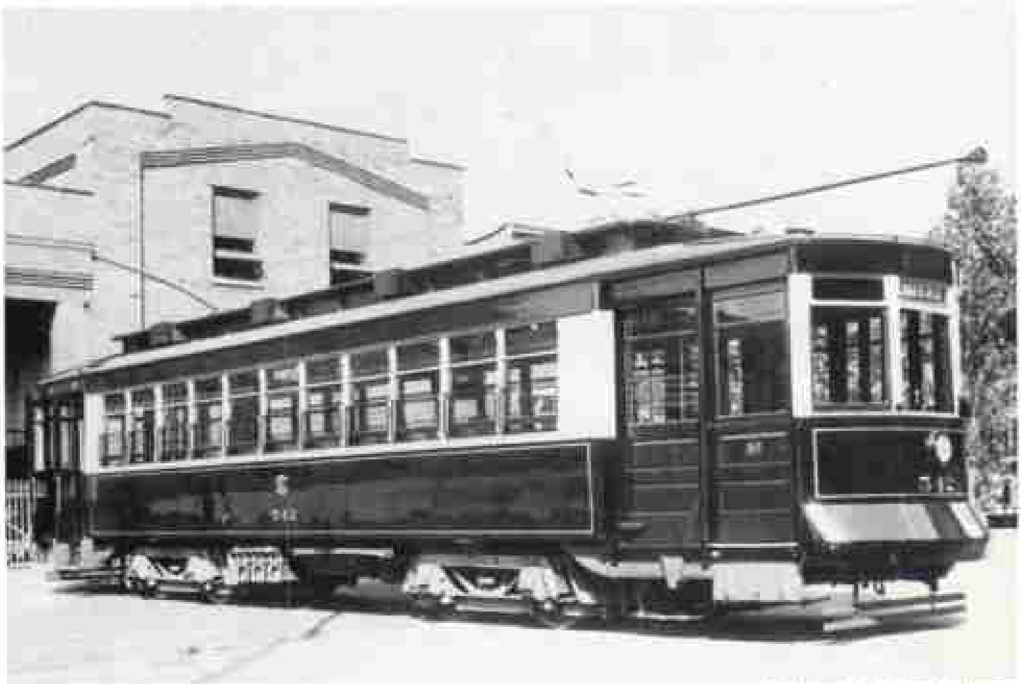
Drawn by:
J. HAROLD GEISSEL
ALLEN J. BREWSTER

THE 950 wood-sided cars of this type were the backbone of the Chicago Surface Lines fleet. They were built by Pullman (which has a plant in Chicago's southern outskirts), and they comprised the largest individual group of cars on the system. The first series, Nos. 101-700, was built in 1908 and 1909. They had BP-150 trucks and four GE 216 motors. Air doors were fitted to 110 cars. Between 1921 and 1936 some cars were fitted with couplers for hauling trailers. The second series, Nos. 751-1100, was built in 1910. These cars also had BP-150 trucks but were powered by four W319B motors.

The cars were relatively speedy and became known to some as "red rockets." They were painted red, with cream trim at the windows. The doors were brown. The roof and the underbody were black. Lettering and striping were silver. They were used mainly on the system's northwest lines but sometimes they operated on all lines. The cars were in service for nearly 50 years and were quite dependable. The Pullmans got through mud, sleet, and snow when other cars were stalled by the weather. No. 144 is preserved at the Illinois Railway Museum, Union, Ill., No. 225, at Kennebunkport, Me., No. 460, in the CTA collection.

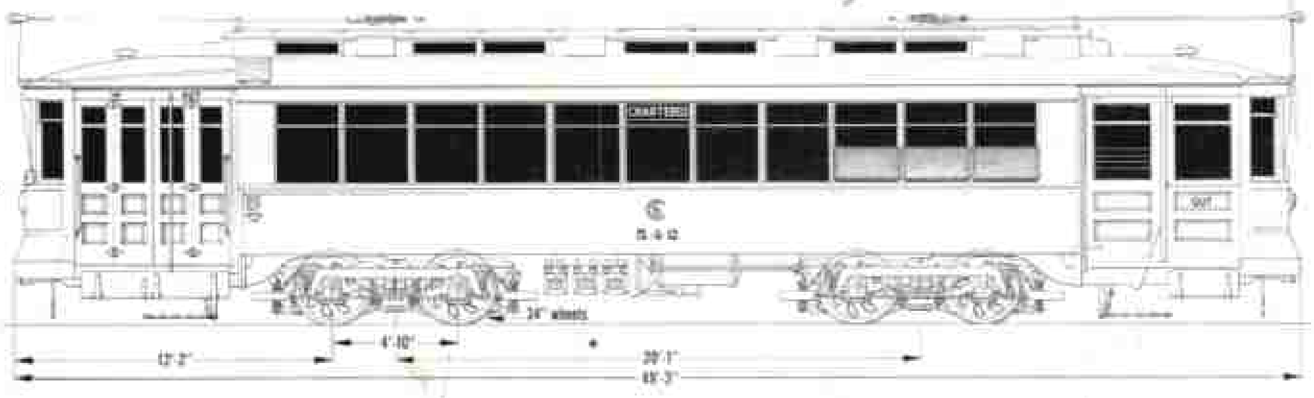


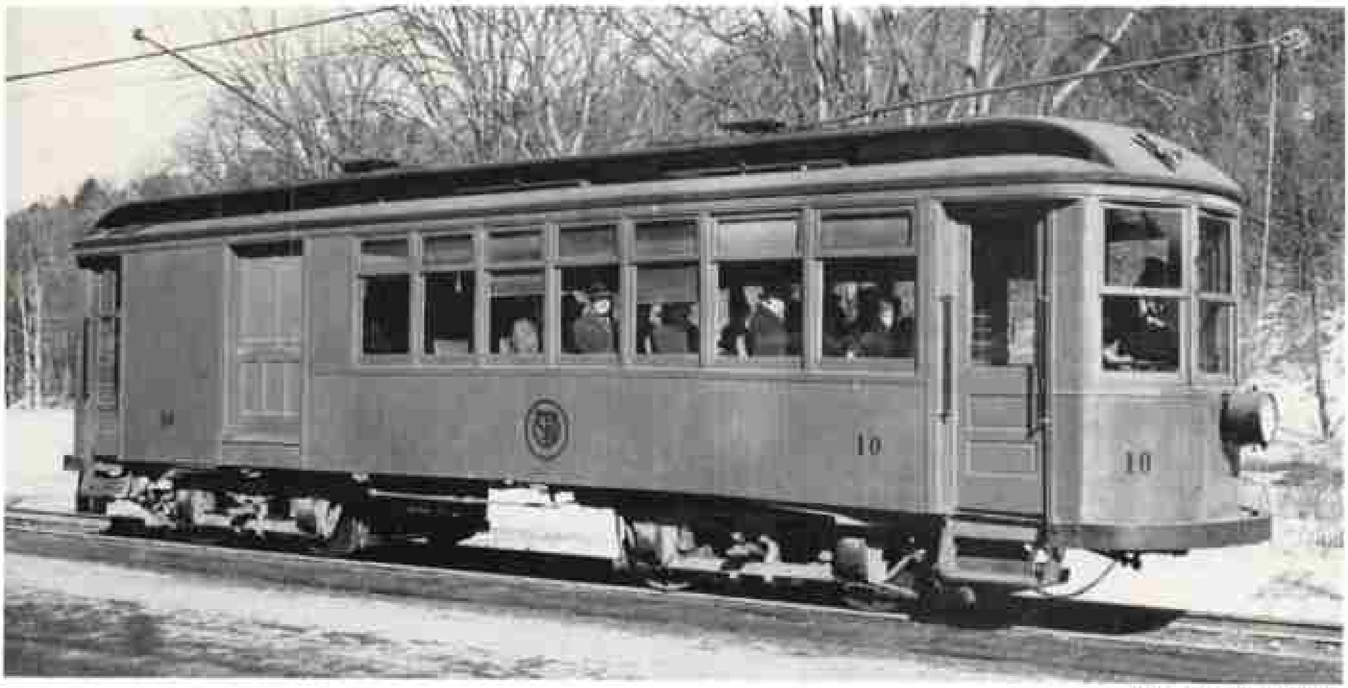




Collection of William J. Cloney

Ratio 1:87 HO scale



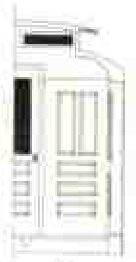


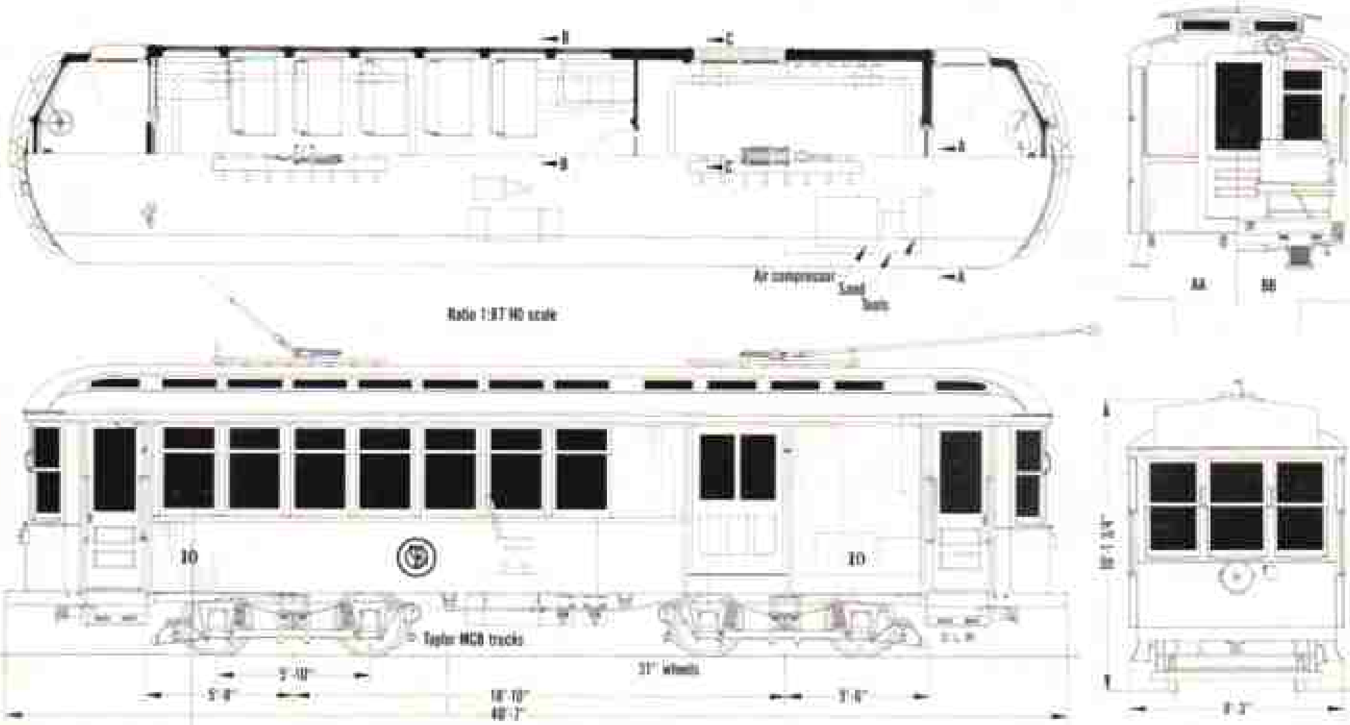
Both photos, Roger Borrup

THIS low-slung combine was built by the Wason Manufacturing Company of Springfield, Mass., for the Springfield (Vt.) Electric Railway, later renamed the Springfield Terminal Railway. The car was used until 1945 and is now the property of the Connecticut Electric Railway Association, Warehouse Point, Conn. No trucks of the type used on this car are available commercially, but any old-style design would look appropriate.

Vermont interurban

Drawn by:
DAVID L. WADDINGTON





All photos, Industrial Photo Service

ITS Class B freight locomotive

Drawn by:
ALFRED E. BARKER

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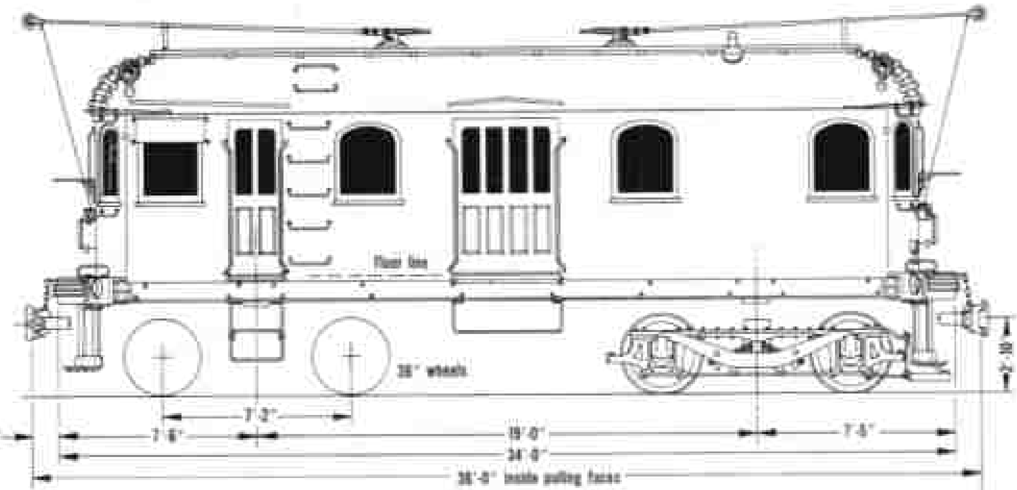

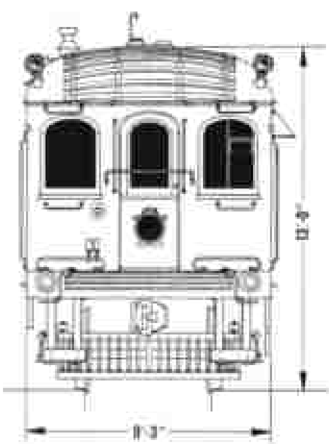

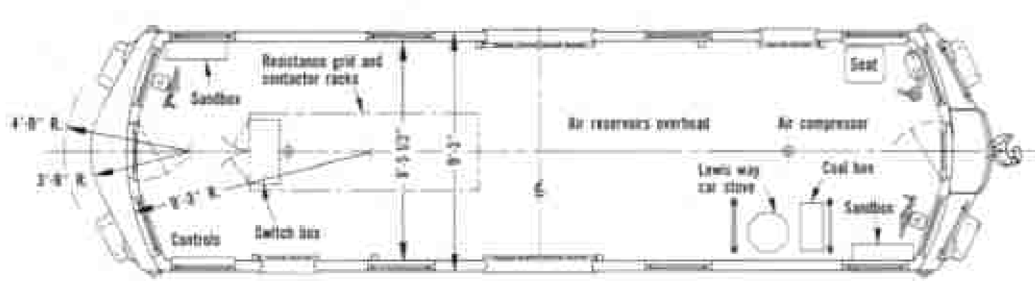

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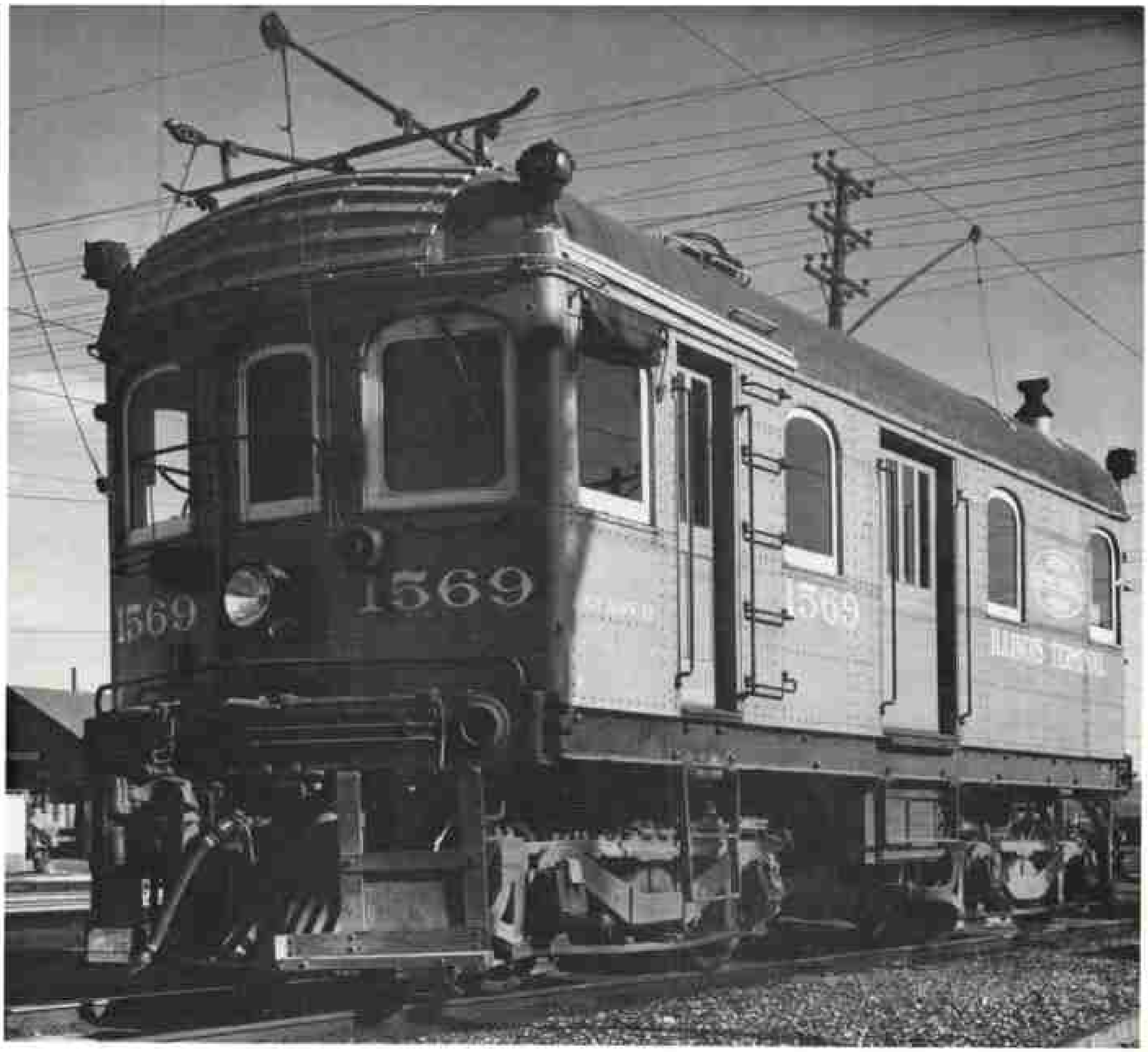
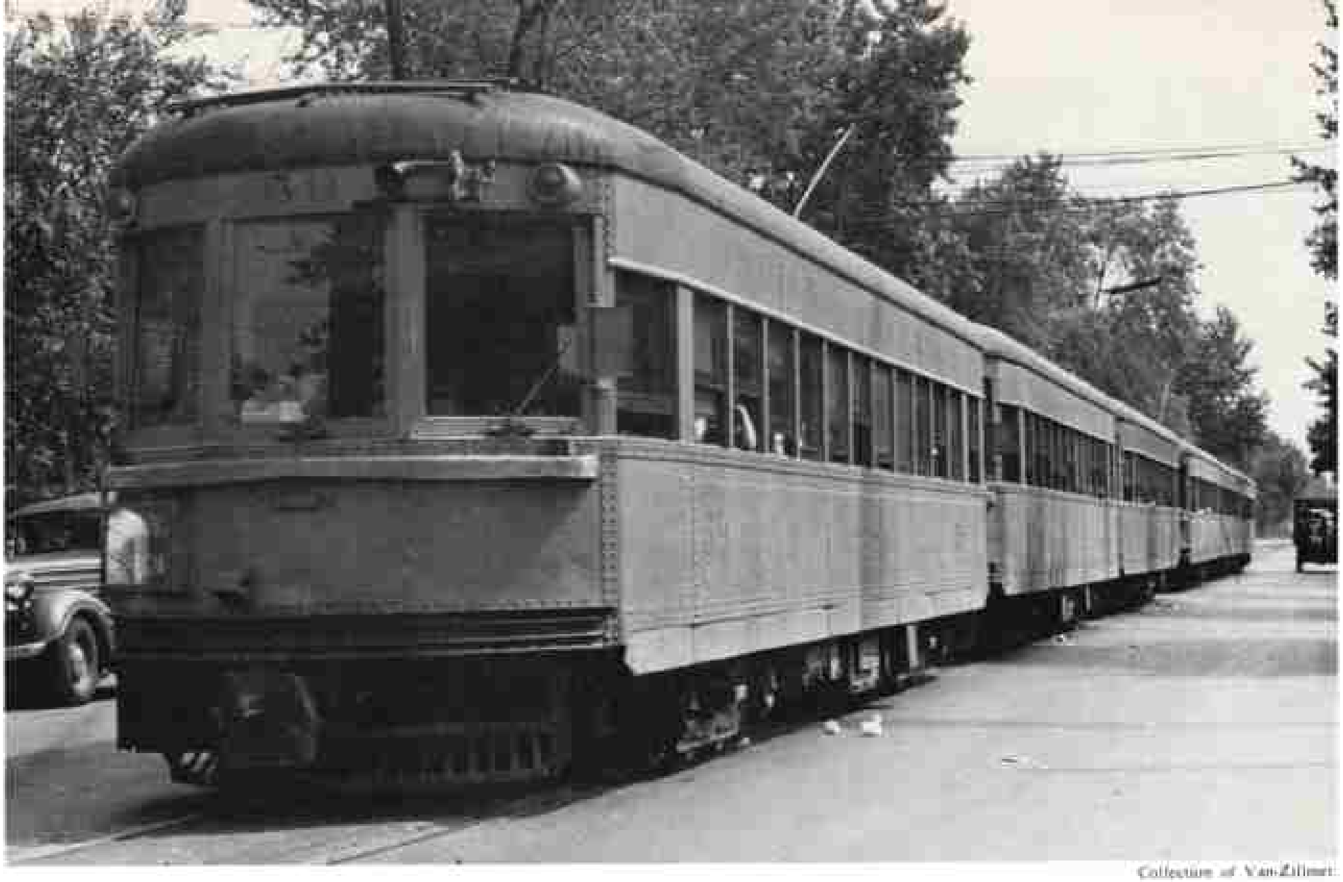


FROM 1919 until the middle 1920's the prime freight movers on the sprawling Illinois Traction System (renamed Illinois Terminal in 1928) were the Class B locomotives, Nos. 1561-1578 inclusive. The Class B locomotives were designed by the ITS and built in the company shops at Decatur, Ill. Between 1924 and 1930, the IT built the more powerful four-truck Class C locomotives, and the Class B's were relegated to lighter duties.

As originally built, the Class B's weighed 63 tons each, but in later years they were upgraded to achieve better adhesion. As rebuilt, they weighed 80 tons and had 10"-thick concrete floors.

The original color scheme was: roof, terra cotta (reddish brown); sides and ends, Brewster green (similar to Pullman green); sash and doors, maroon; trucks, frame, and underbody details, black; lettering, gold leaf. Subsequent repainting resulted in many of the Class B's being given the traction-orange sides and ends used on IT passenger equipment. Some of the Class B locomotives also were painted with light green sides and ends in later years.

The photo at right shows the 1564 as it looked when new. The other two photos show the 1569 and 1570 after rebuilding.



Collection of Van-Zillmer

Indiana Railroad high-speed car

THE 800-mile Indiana Railroad system was formed in 1930 as the result of consolidating several small, failing interurban lines: Union Traction Company, Northern Indiana Power & Light, Interstate Public Service Company, and the Indiana Service Corporation. Later, parts of the old Terre Haute, Indianapolis & Eastern were added to IRR's system.

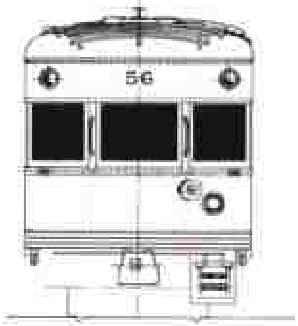
After formation, the Insull-controlled Indiana Railroad immediately embarked upon a rehabilitation program that included new rolling stock, rebuilt power facilities, elimination of tight curves, new belt lines around urban areas, solicitation of interchange freight, and coordinated scheduling of passenger trains.

The new rolling stock delivered in 1931 consisted of 35 lightweight, high-speed cars: 14 38-seat coach-lounge-observation cars, Nos. 50-63, from American Car & Foundry at Jeffersonville, Ind., and 21 40-seat coach-baggage combines, Nos. 64 to 84, from Pullman Car & Manufacturing Company near Chicago. The orange-and-green cars of both companies had almost identical exteriors, the major difference being that the Pullman-built cars had square classification lights, and a baggage door at one end of the car. Aluminum alloys used in construction gave the cars the low center of gravity necessary for high-speed operation (they could attain 83 mph). The 26-ton cars were each powered by four 100-h.p. motors and were designed for one-man operation. The IRR's 600-volt bus trolley system enabled trains of up to three cars to operate off of one trolley pole. The "high-speeds" were principally used on the Indianapolis-Louisville and Indianapolis-Ft. Wayne routes.

Unfortunately the upgrading program arrived too late for the system, and the IRR went into receivership in 1933. Passenger service ended in 1941.

Car No. 65 became No. 120 on the Cedar Rapids & Iowa City (left) in 1941, and now operates (again as IRR 65) at the Illinois Railway Museum in Union, Ill. Car No. 55, which had been converted to a full lounge, was sold to the Lehigh Valley Transit and renumbered 1030 (facing page, above). It now resides at the Seashore Trolley Museum near Kennebunkport, Maine.

William D. Middleton



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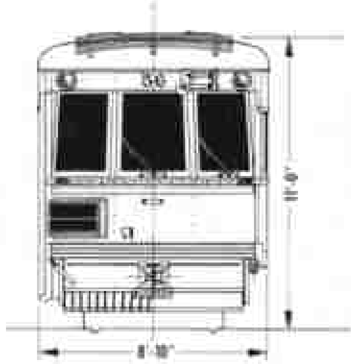
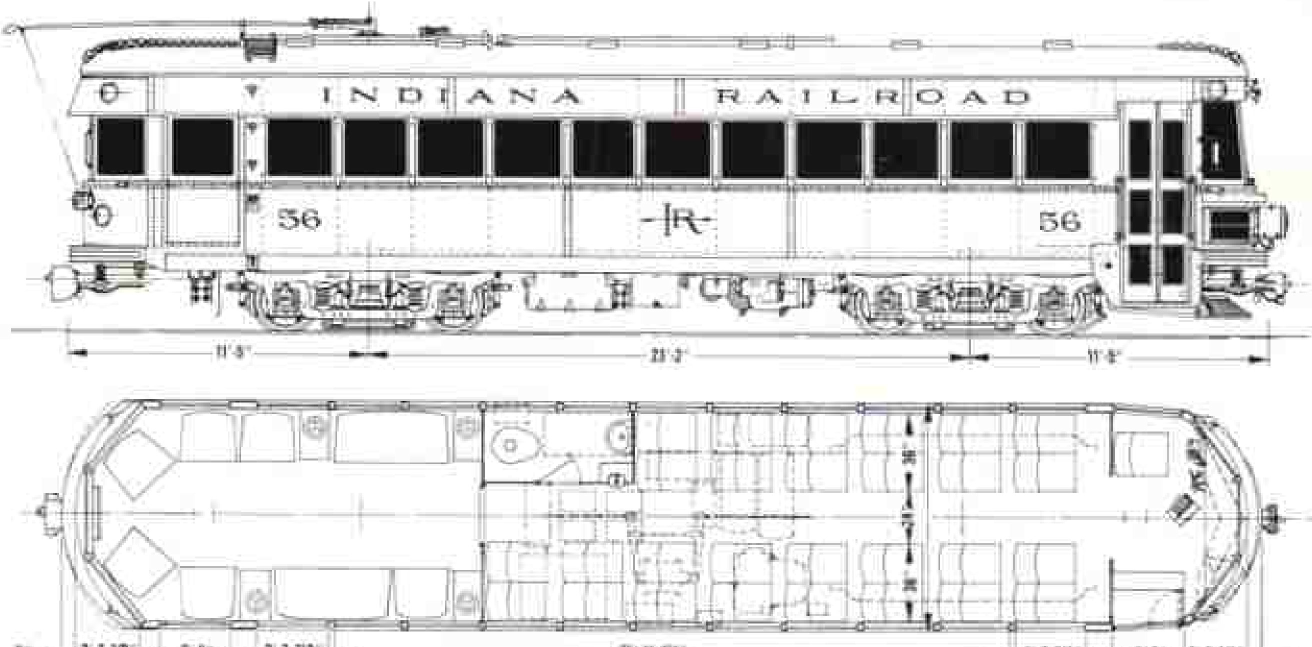
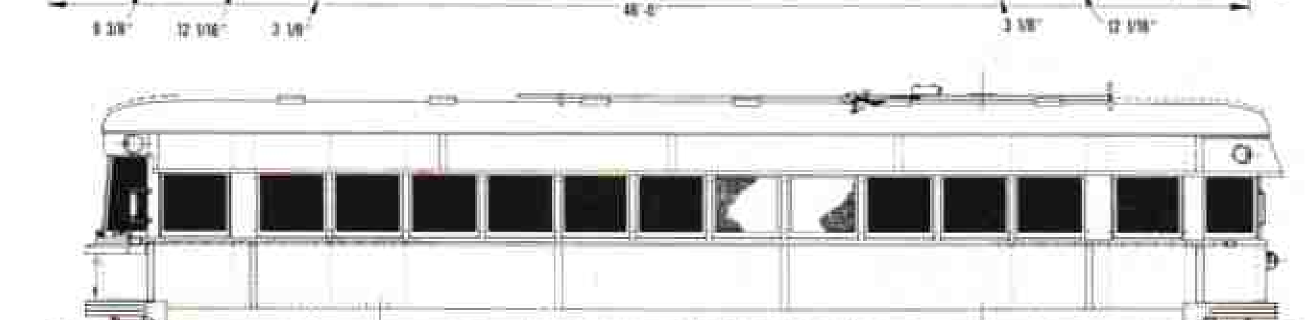
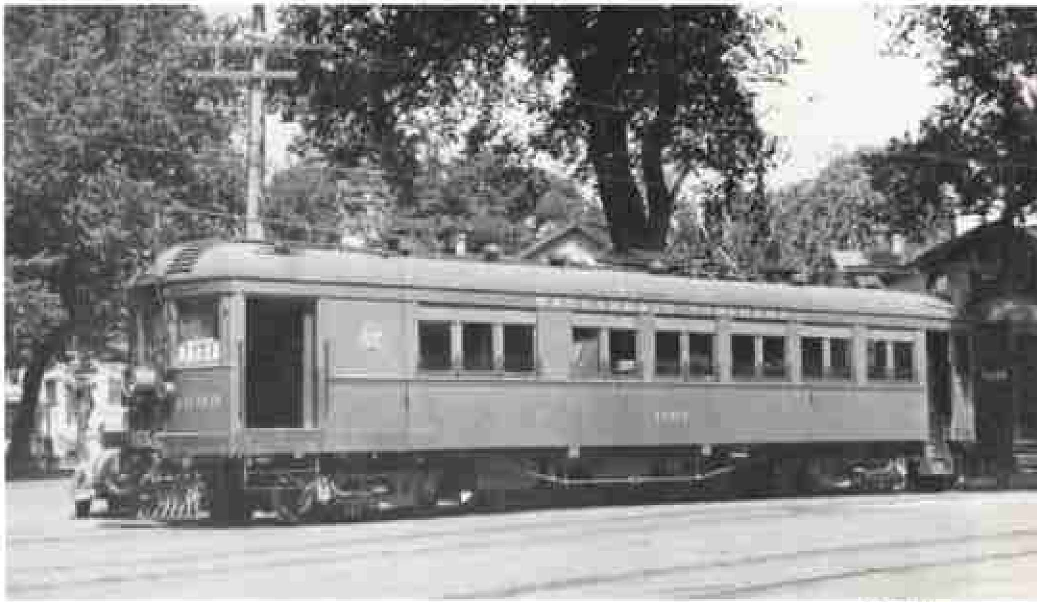








Ralph Demoro

R. H. Ward

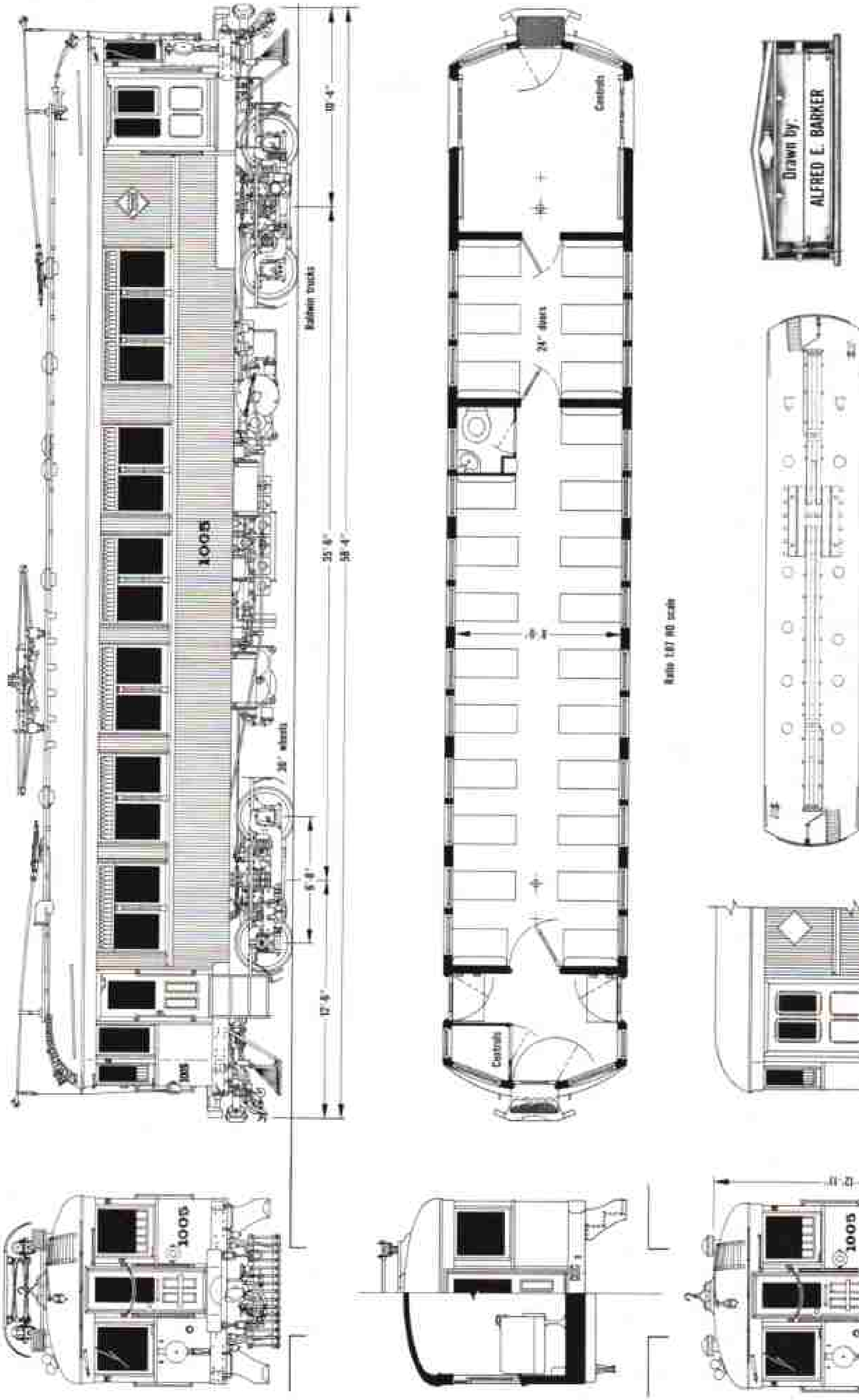
Sacramento Northern interurban

THIS was one of the first group of passenger motor cars purchased by the Oakland, Antioch & Eastern Railway, the southern section predecessor of the Sacramento Northern. They were built by the Holman Car Company in 1912, and regular passenger service was started early in 1913. Originally the cars were equipped with Brown roller pantographs; later they were changed to US 122 pantographs. Although these cars were built as an order, various modifications through the years resulted in minor but noticeable differences. Car No. 1004 was wrecked in 1938 and retired from service. No. 1003 was scrapped with the demise of the Sacramento Northern.

Nos. 1005, 1006, 1010, 1015, and 1018 (Key System 495, 496, 497, 498, and 499) were acquired by the California Toll Bridge Authority in connection with the installation of ATC for bridge operation in 1938. During the war years, the cars were purchased by the Key System to supplement the overtaxed articulated Key units.

The cars were outshopped with such changes as seats in the baggage compartment and a pantograph on one end. They were repainted Key System orange and cream. With the end of the war and the decrease in passenger traffic, the cars were retired, except Nos. 1018 and 1005.

The Bay Area Electric Railroad Association (California Railway Museum) secured No. 495 and restored it as closely as possible to its original condition as Sacramento Northern 1005. The color is coach green, with green trucks, and the roof, body details, and underbody equipment are black. The drawing depicts the car as restored, including the Westinghouse pantograph. Note that there are two styles of third-rail shoes and three distinct types of journal boxes mounted on the tracks.



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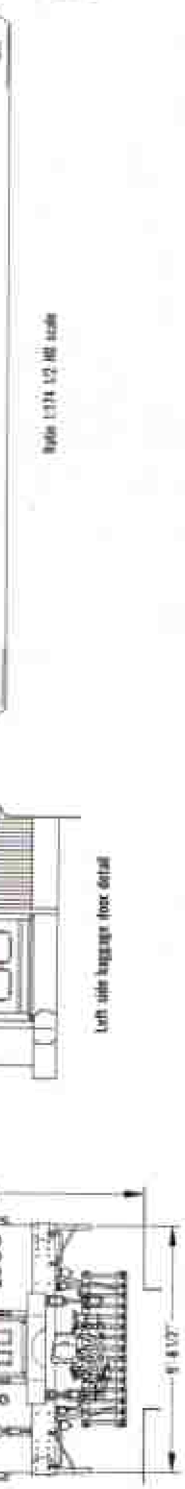

Collection of William J. Clouser.

Collection of Stephen D. Maguire

CD&M parlor car

COLUMBUS, DELAWARE & MARION parlor cars Nos. 500 and 501 were built in 1926 at American Car & Foundry's Jeffersonville, Ind., plant. At that time, the future of interurban travel seemed bright, and the CD&M's luxury parlor cars were intended to lure patronage from the highways. The line operated frequent service between downtown Columbus and Marion, O., a distance of 45 miles, and also provided service to Bucyrus, O., over an additional 18 miles of route. At Columbus the CD&M connected with other lines of the fabulous Midwestern interurban network.

So, in 1926, the investment in two heavyweight two-man parlor cars seemed justified. Seven years later (August 21, 1933), automobiles had exacted their toll and the CD&M ceased operations.

The line — for its size — had an impressive roster of equipment. Poor's *Public Utilities* for 1930 listed 9 standard interurbans, 3 parlor cars, 4 freight and express motors, 11 box trailers, 20 flat, dump, and work cars, and 2 motor snowplows.

The 500 and 501 were large cars. An overall length of 62 feet and width of almost 9 feet provided ample space for each car's 36 passengers. Large rear windows permitted passengers an excellent view of the countryside. An 8-passenger smoking compartment provided refuge for gentlemen needing tobacco.

The 500 and 501 were equipped with Baldwin 84-45AA trucks (two traction motors per truck) and standard knuckle couplers fitted with radial carriers — a necessity for negotiating tight curves.

Drawn by:
ALFRED E. BARKER

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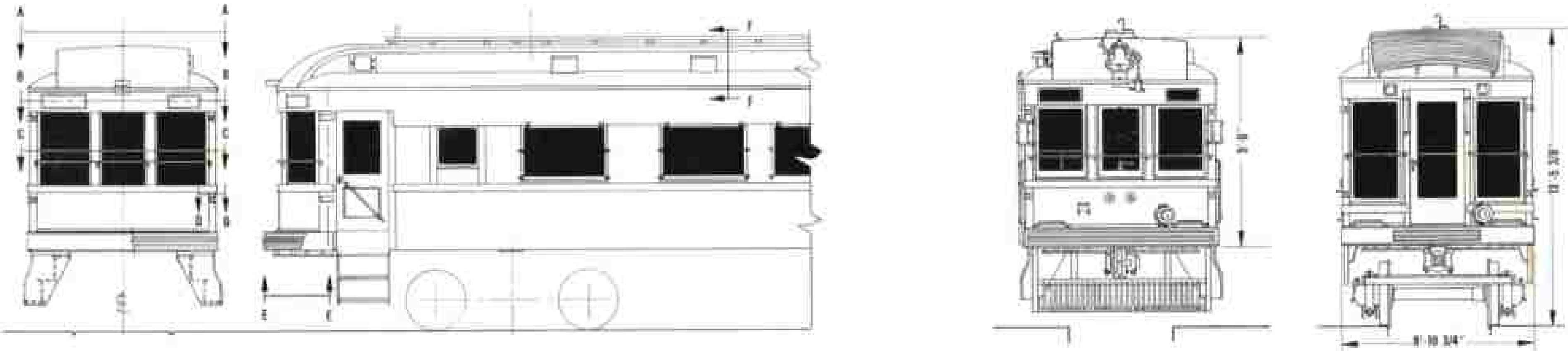
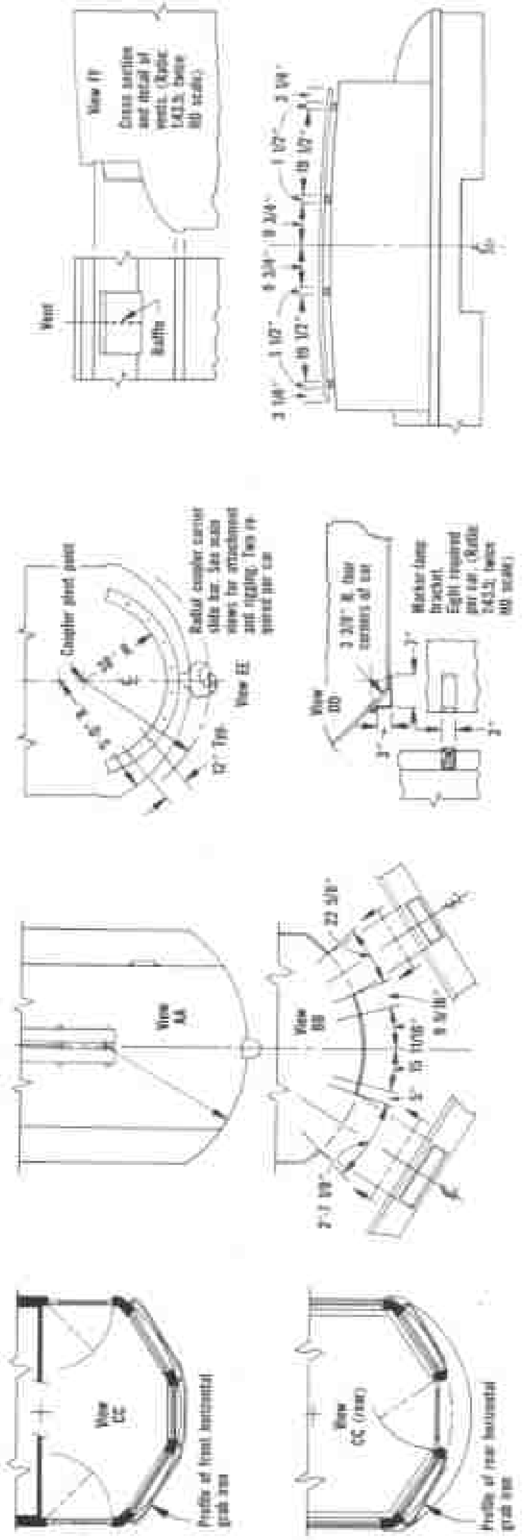
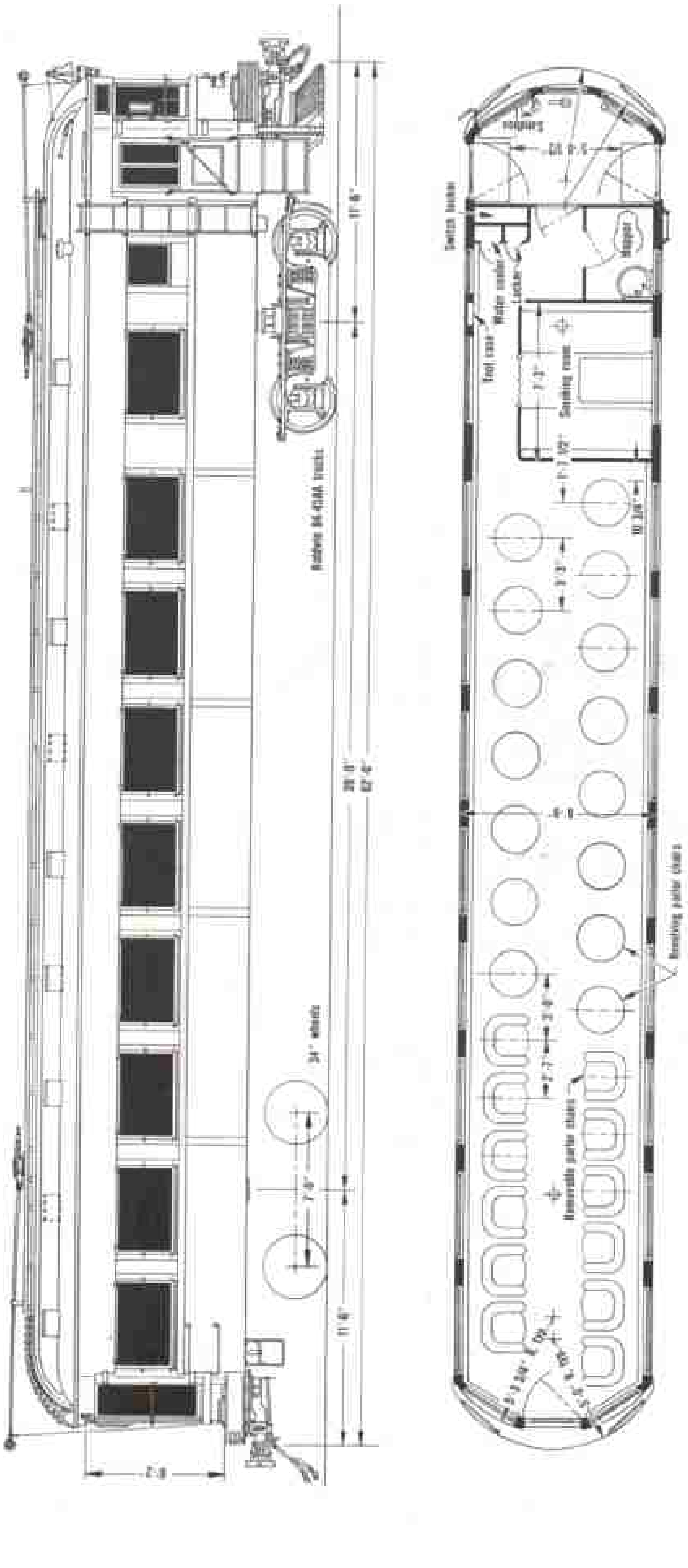
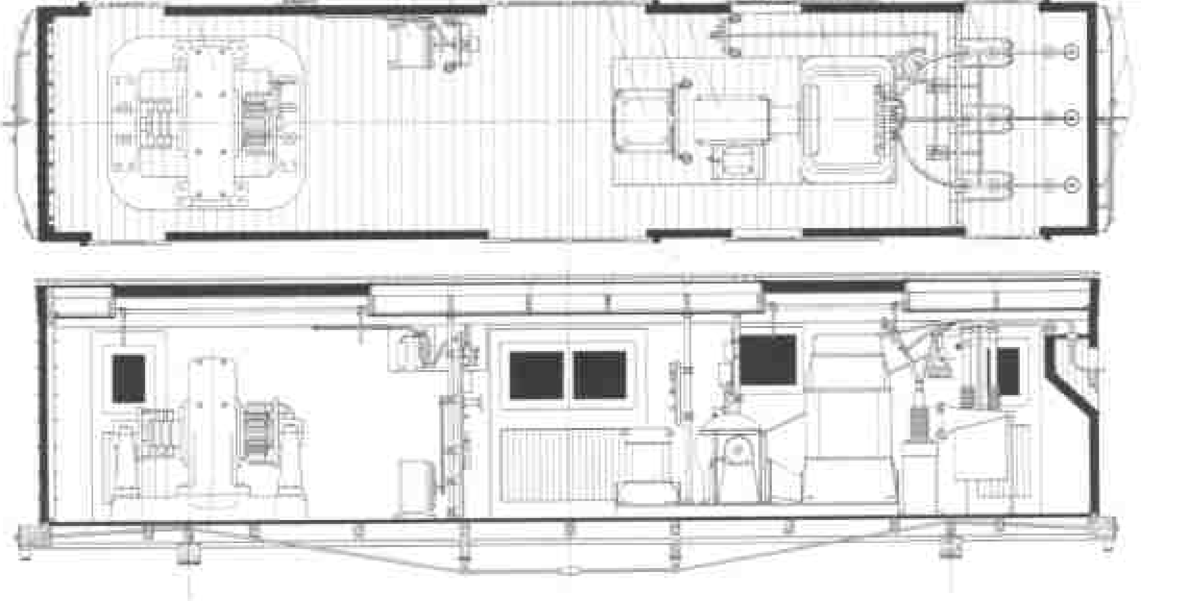
Ratio 1:87 HO scale except as noted







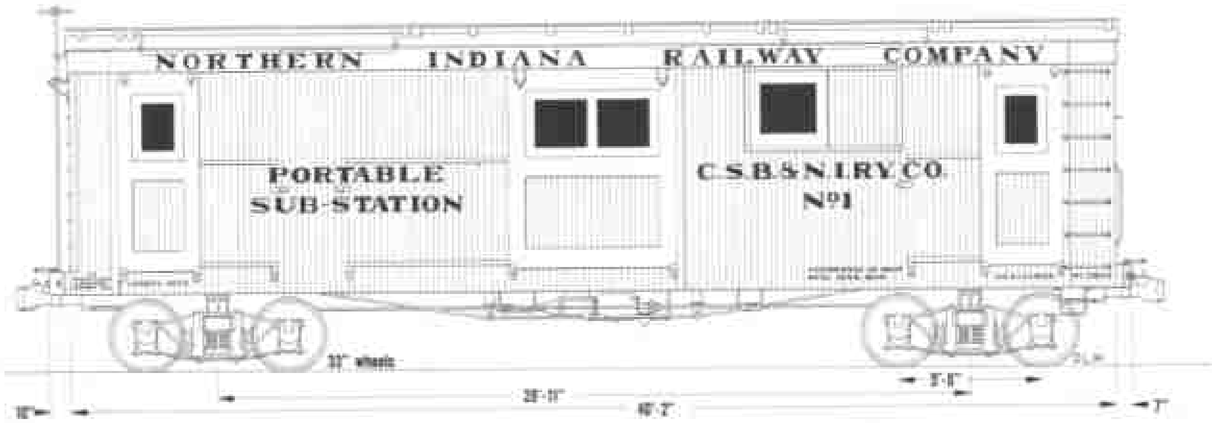
Collection of William J. Clouser



Portable substations for electric railways

Drawn by: DAVID L. WADDINGTON

MOST of the power used on an electric railway was converted from a.c. to d.c. in fixed substations, but sometimes portable substations also were used. These were usually built inside old wooden carbodies, but some were built in new metal cars made for the purpose. Portable substations were shifted about to take care of temporary overloads that might occur when extra trains were operated to county fairs or amusement parks on holidays such as the Fourth of July. Some roads had shifting power demands in summer when traffic to resorts increased. Portable substations also were used along new lines until a fixed substation was put into operation; sometimes they were permanently assigned to a lightly trafficked branchline.



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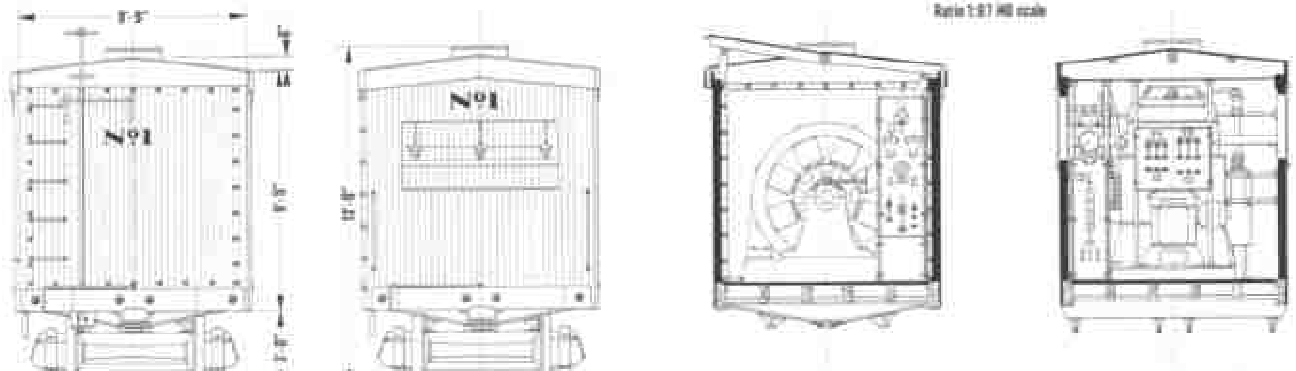
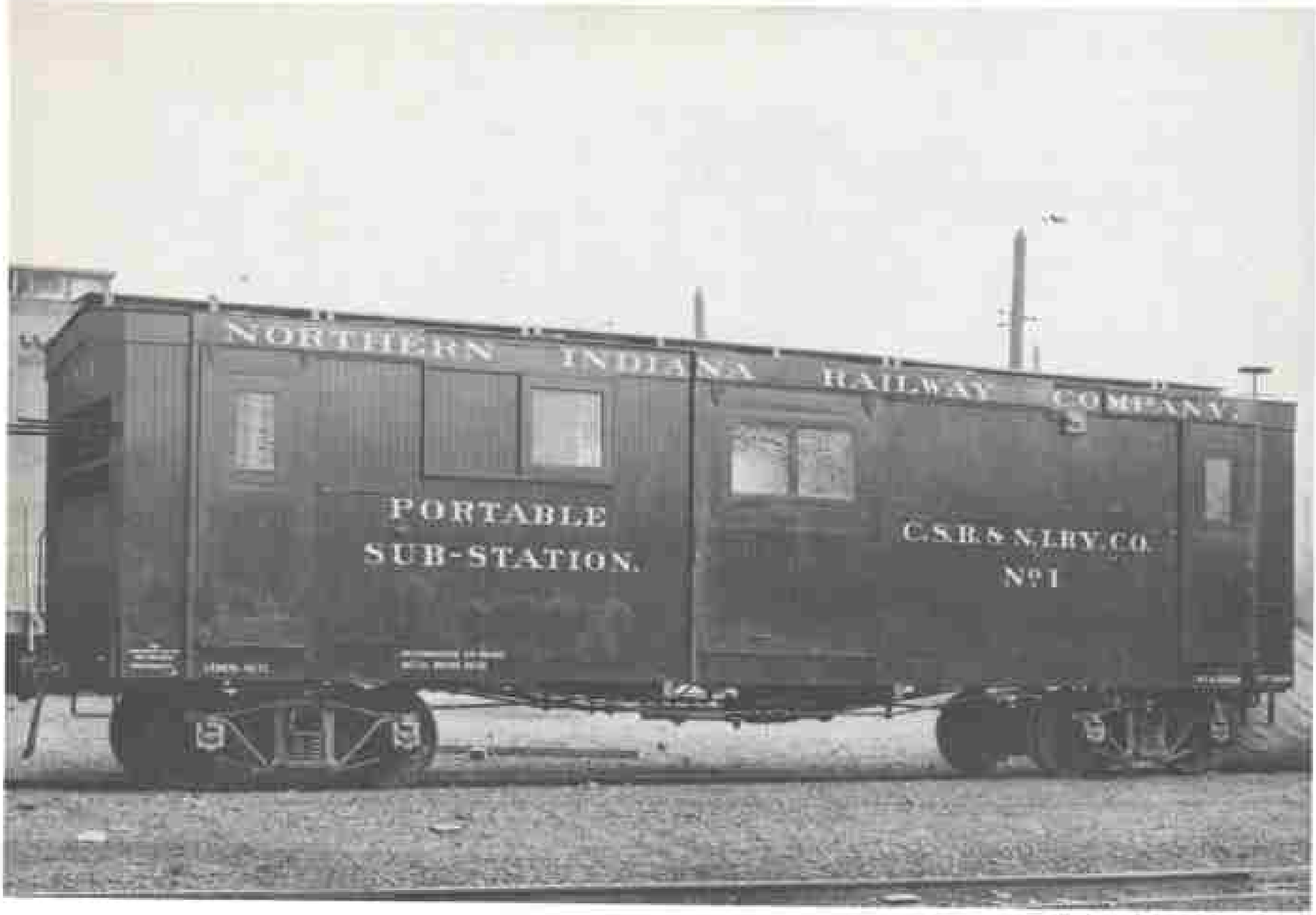
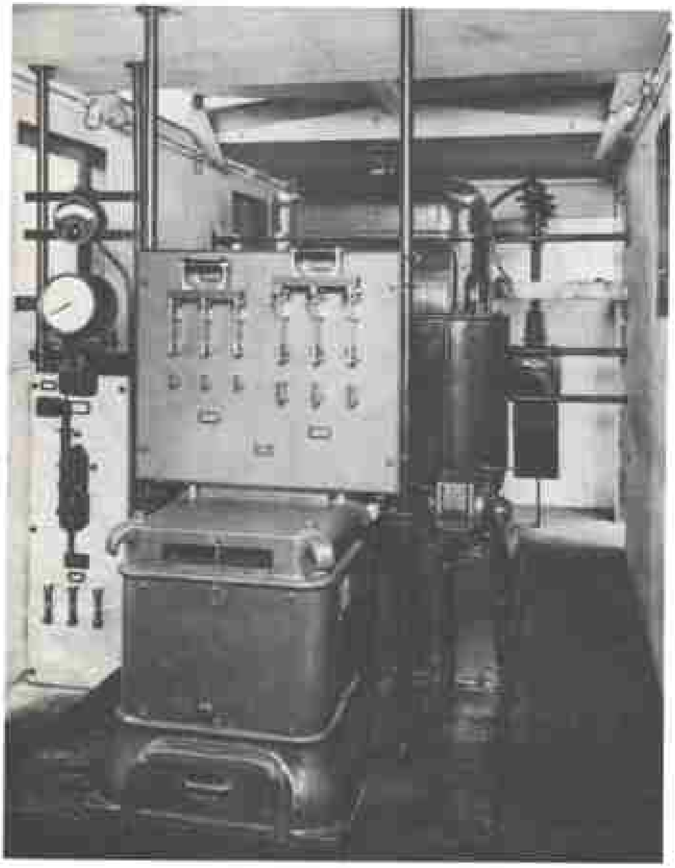




All photos, Industrial Photo Service.



■ DESIGNS FOR TRACTION LAYOUTS

BY E. S. SEELEY JR., GEORGE H. DRURY, AND MIKE SCHAFER

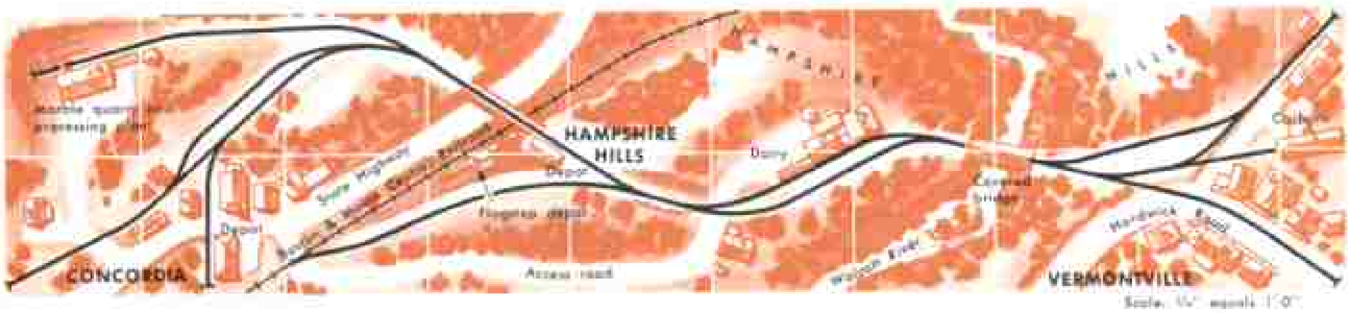
ON the following pages are plans for several model electric railways — ranging in size from simple shelf layouts to a full-size around-the-room interurban road — as inspiration for the modeler about to embark on the construction of his own traction empire. Keep in mind that these pikes merely represent suggestions for electric railway layouts. You should adapt or alter plans to suit your own needs, whether by changing the size of the plan, adding or subtracting tracks, or simply by changing the names of the railroad and the towns it serves. For that matter, you need not follow these plans at all, but just pondering them may lead you to dream up a completely new and different traction line that meets your fancy.

If you are a beginner, it would be wise for you to start with one of the simpler layouts shown in this section. A good idea would be to begin by equipping your traction line with one or two ready-to-run interurban cars that can be operated on a layout wired in common two-rail fashion. For simplicity in wiring, many of the layouts presented contain no reverse loops or wyes, although these can be added easily once you gain experience with wiring and operating your pike (Kalmbach's softcover book HOW TO WIRE YOUR MODEL RAILROAD covers general wiring for model railroads). Ultimately, trolley wire can be hung for realistic and authentic overhead power distribution.

Interurban lines in the East, the Midwest, and the Far West had their own regional characteristics. Eastern lines tended to be true "between city" lines; Midwestern interurbans joined comparatively distant cities and served the farmlands between; in the Far West the interurban more closely resembled an electrified shortline railroad with carload freight operations not usually found in the East or Midwest. Each layout in this section displays — at least in part — one of these themes or regional characteristics.

Shelf layouts

Space-saving shelf layouts will fit almost anywhere

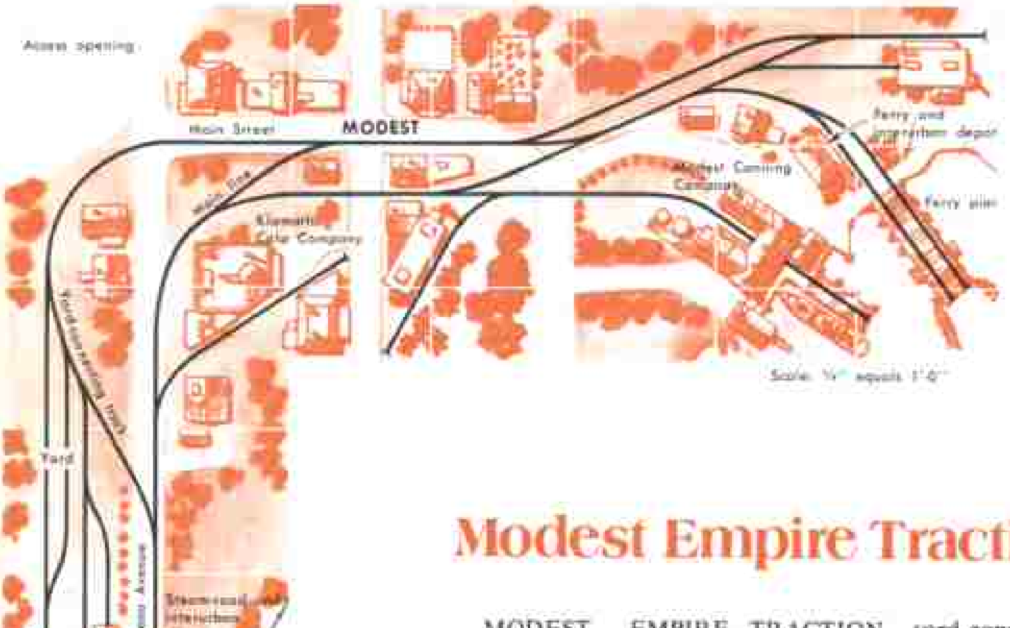


Hampshire Hills Traction

HAMPSHIRE HILLS TRACTION LINES is one of the simplest railroads that can be modeled on a shelf. New England trolley lines represented a rural way of life; most of them were built only to street-railway standards and only connected nearby cities, thus the cars of such lines rarely exceeded 15 to 20 mph as they bounced and rolled in leisurely fashion through the hilly countryside of northeastern United States.

The HHT connects the two small towns of Concordia and Vermontville, the latter being the site of HHT's carbarns. At Hampshire Hills, midway between the two villages, the line interchanges with a steam railroad, the Boston & Maine Central Railway. Freight interchange is HHT's major source of income. Passenger service operates between Concordia and Vermontville, with a stop at Hampshire Hills for passengers transferring to steam-road trains.

Hampshire Hills Traction can be expanded easily to serve additional towns, either by adding more shelves and trackage to one end of the layout, or by growing out from both ends. Many railroads and interurban lines located their main yards and carbarns at a middle point on the system's line, with trains working outward from this central location to endpoint destinations.



Modest Empire Traction

MODEST EMPIRE TRACTION COMPANY is both a shortline interurban railway and an industrial switching line. Both types of railroads are adaptable to shelf-type layout construction.

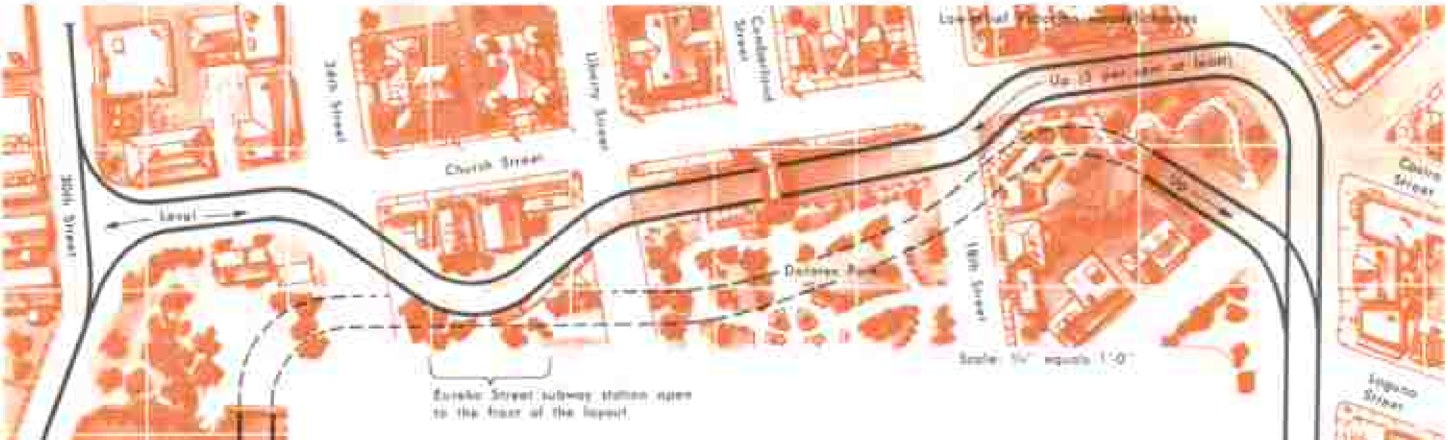
MET ties Modest, located on the shores of a bay, to an industrial section of nearby Empire. Modest is the site of a ferry landing; freight and passengers arrive on railroad carferries connecting with the steam road that terminates on the opposite shore of the bay.

An interchange in Empire with the Pacific Southern Railroad gives MET two important functions: First, the MET performs a transfer service; freight cars are taken from the ferry at Modest to the PS. Second, MET acts as an industrial switching line for the Pacific Southern, parent company of the Modest Empire Traction Company. A small amount of passenger service provides some extra activity on the line.

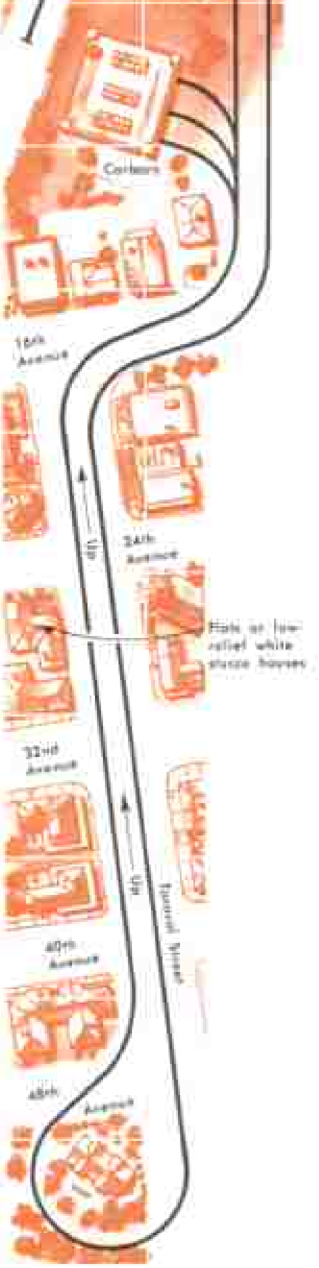
The action begins with the arrival of the ferry at Modest. First, ferry passengers are transferred to a small semi-open car for the shuttle run to Empire. The car departs, and a steeplecab locomotive moves in to pull freight cars off the ferry. The passenger run makes one or two stops along Main Street, turns onto Pasadena Avenue, and then grinds to a halt ahead of the switch to the yard-connecting track. Another freight motor — a small box-cab — moves off the Pacific Southern interchange with a load of freight cars bound for the ferry dock for the next sailing. The box-cab moves around the waiting passenger run via the yard-connecting track, and the interurban car moves forward to its stop next to the PS depot where passengers disembark for steam-road trains. The car then rolls along to the station at the end of the line, where remaining passengers detrain and new ones step aboard for the return run to the ferry. Empire is also served by larger interurban lines, hence MET never has sought an expanded passenger market; passengers merely are let off at this depot at the edge of downtown Empire. In fact, the track ends in the middle of the street at this point.

Back at the dock, the steeplecab departs for downtown Empire and will do work along the way. Meanwhile, the box-cab waits in the middle of Main Street (much to the annoyance of motorists!) for the steeplecab to clear on the main track. The box-cab then moves in to push freight cars aboard the waiting ferry. While the steeplecab works the industries along the main line (Klamath Cola, Modest Canning, and so forth), the passenger shuttle moves toward the Modest ferry depot, probably via the yard-connecting track in order to get around the steeplecab. By now the box-cab will be finished with its work and out of the way for the incoming passenger run from downtown Empire. With that, the semi-open car rolls in, discharges passengers for the ferry, and the boat departs.

You can see that MET keeps active with its interchange, yard area, and numerous industrial sidings. The layout could be operated easily by a two-man team because Modest Empire Traction is one of the busiest railroads of its size.



San Francisco "Muni"



MUNICIPAL RAILWAY is a representation of the San Francisco Municipal Railway. The prototype "Muni," as it often is called, is best known for its cable cars, but most of the city's transit riders use its large fleet of diesel and trolley buses and streamlined PCC streetcars.

San Francisco's topography has produced some picturesque streetcar lines that would make excellent modeling subjects. Selective condensation of the 35 miles of route gives us an around-the-wall shelf layout.

Of the five remaining streetcar lines in San Francisco, the Church Street line has the most to recommend it for modeling: private right of way on a steep grade through a park, a couple of sharp curves that restrict certain classes of cars from using the line, and a T-shaped wye at the end of the line. The wye has special overhead frogs for backpoling through the switch. Grooves in the street beyond the ends of the track attest to slippery rail and brakes sometimes applied too late.

Our modeling of the Muni also should include one of the two tunnels that take the cars to the western part of the city. The Twin Peaks tunnel is the one we chose, because it has two subway stations, one of which can be modeled under the front edge of the table.

Model the Taraval Street line so that it descends to the beach in a series of "stairsteps," level at the cross streets and downhill between.

Three miles of Market Street have been condensed to three blocks on our layout. The wye at Eleventh Street is used for turning cars going from the carbarn to the other lines. At Powell Street there is space to model a cable-car turntable with a cable car (so your visitors will know immediately that this is San Francisco). Don't forget the crowds of people waiting to board the car.

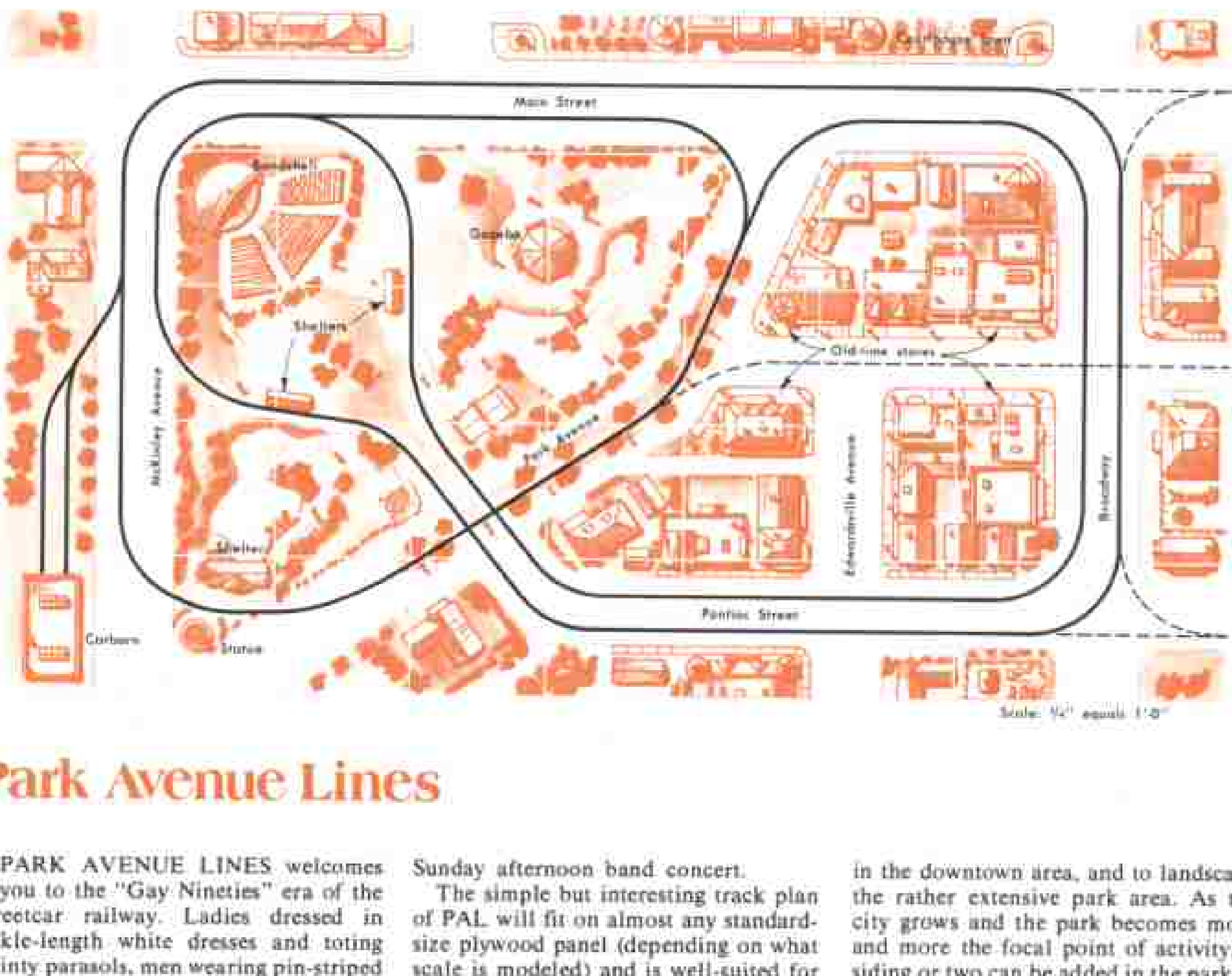
We use modelers's license to move the carbarn to the west portal of the tunnel. Similarly we can move the East Bay Terminal a block north to Market Street to avoid widening our shelf layout. Today the prototype terminal is host to buses from the East Bay area and from Amtrak's Oakland station, but it was once the terminal for the Key System, the Sacramento Northern, and SP's Interurban Electric Railway.

Operation on the model version of the Muni follows the prototype closely. PCC cars leave the carbarn early in the morning en route to the ends of the lines, which means a trip to Eleventh Street for the Church Street cars. Rush hour, of course, brings more cars out, either PCC's or, to back up a few years, the old heavyweight cars known as "Iron Monsters." An occasional special movement can bring out the last of the Iron Monsters, No. 1, in its gray-and-maroon livery with a destination sign reading NOWHERE IN PARTICULAR. For variety of operation you can bring out the wrecker to tow home a disabled car, and the line car can make a trip from time to time.

This layout has possibilities for automatic operation over parts of the line, and you may want to investigate operation of two cars on the same section of track, using overhead wire and the left rail for one and overhead and the right rail for the other.

Table layouts

The versatile table layout provides a basis for many different kinds of operation



Scale: 1/4" equals 1'0"

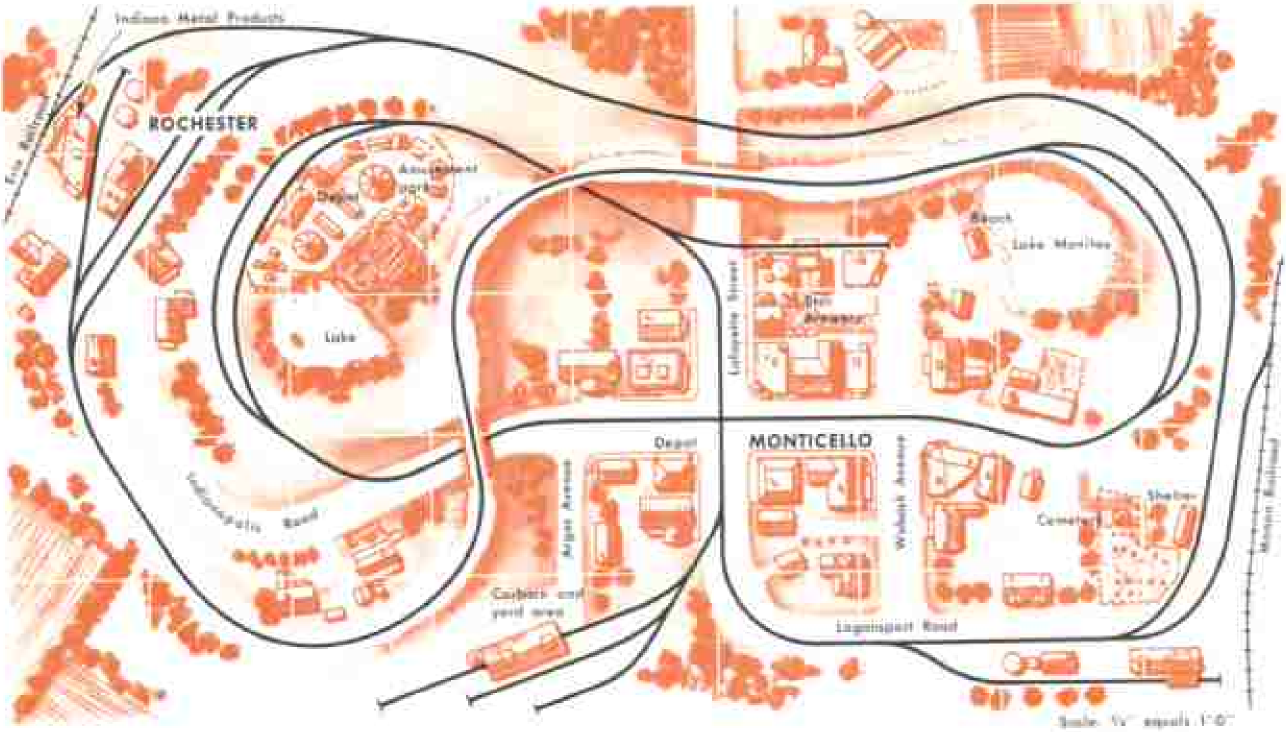
Park Avenue Lines

PARK AVENUE LINES welcomes you to the "Gay Nineties" era of the streetcar railway. Ladies dressed in ankle-length white dresses and toting dainty parasols, men wearing pin-striped suits and displaying handlebar moustaches, and "newfangled" gasoline carriages rolling down the street are all a part of this turn-of-the-century scene. In that day and age, the city park was the main gathering place for the townsfolk, and people flocked aboard the bouncing city cars for the ride to the park for a Sunday afternoon band concert.

The simple but interesting track plan of PAL will fit on almost any standard-size plywood panel (depending on what scale is modeled) and is well-suited for expansion by adding a table adjacent to the existing one. Dotted lines indicate where new track routes could diverge from original lines if the layout were expanded.

Park Avenue Lines offers the modeler the opportunity to construct street trackwork, to build old-time stores and shops in the downtown area, and to landscape the rather extensive park area. As the city grows and the park becomes more and more the focal point of activity, a siding or two can be added in the park to hold special cars that travel across town with excursionists.

Although two cars can be operated in opposite directions on the Park Avenue Lines (despite the absence of passing sidings), it is more interesting to have two or more cars running in the same direction.



Indiana Terminal Railway

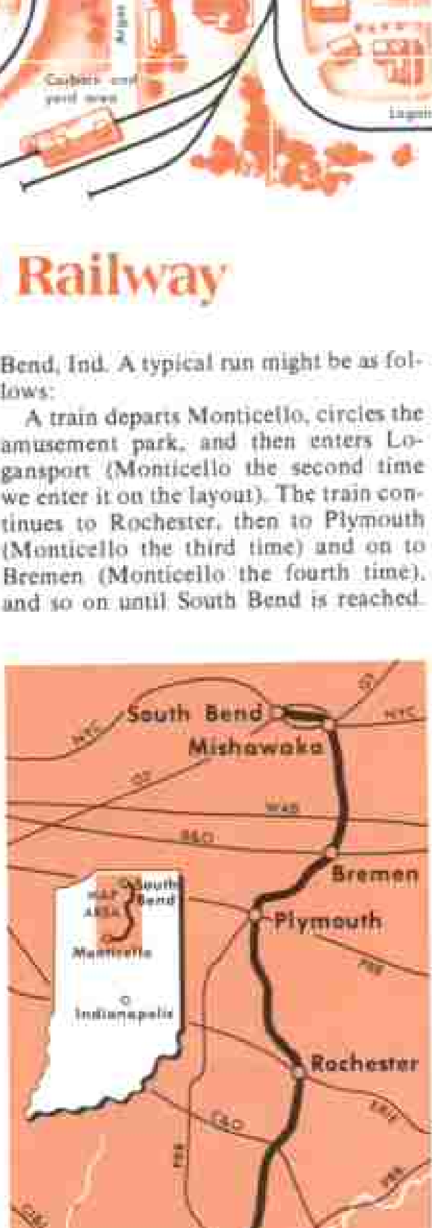
INDIANA TERMINAL RAILWAY is an action-packed interurban layout that depicts the classical electric intercity railway of the 1930's, when big steel interurban cars whipping through the countryside with trolley pole zinging were an everyday sight to the people of the Midwest. This was the region of the United States where interurbans reached their peak of development.

The ITR has fast mainline trackage, and features upper-tier trackwork to relieve the flatness found on many table layouts. The line connects the respectable-size (for a model railroad layout) community of Monticello with Rochester, and also serves Lakeview Amusement Park not too far out of Monticello. Look again at the layout plan and you will note that there are several sidings and industrial spurs. The ITR will allow you to take those big freight motors (such as the C&LE freight motors featured on pages 88 and 89, or even a version of the Illinois Terminal Class B shown on page 102) out on the line and do a significant amount of freight operation (while dodging the regular passenger runs).

There are a number of operational possibilities on the Indiana Terminal Railway, one being a lap method whereby Monticello and Rochester become different towns each time a train enters them on a run. This way, the modeler can imagine the ITR's route to be any length he wants it to be.

The map of our fictitious ITR shows the line as it might be routed if it stretched from Monticello to, say, South Bend, Ind. A typical run might be as follows:

A train departs Monticello, circles the amusement park, and then enters Logansport (Monticello the second time we enter it on the layout). The train continues to Rochester, then to Plymouth (Monticello the third time) and on to Bremen (Monticello the fourth time), and so on until South Bend is reached.



Rochester's name only gets changed once on this routing — it becomes Mishawaka the second time we enter it. The reverse also works; a train can start out from South Bend and work its way south to Monticello.

Keeping the above pattern in mind, here is a more complex operation using two trains:

The first ITR train of the day, the *Hoosierland Limited*, departs Monticello early in the morning and travels to Logansport, Rochester, and Plymouth. At Plymouth, the train's diner-lounge is dropped off (by now, breakfast has been served, and the train will be arriving in South Bend before lunchtime). The *Limited* proceeds out of Plymouth and makes a stop at the amusement park. At this time, the southbound *Monticello Express* departs from South Bend. As the *Hoosierland Limited* stops in Bremen, the southbound *Express* makes its stop in Mishawaka; the two trains meet at the siding just outside of Bremen. By the time the *Express* arrives at the amusement park stop, the *Hoosierland Limited* has reached South Bend. The southbound *Monticello Express* moves into Plymouth and picks up the diner-lounge dropped off by the northbound *Hoosierland* and continues to Monticello.

To make operation still more interesting and varied, some passenger trains could operate only between Plymouth and Monticello, and others only between South Bend and Plymouth. On top of all this action add an interurban freight train, and you have one very active Indiana Terminal Railway!

Liberty Bell Traction

LIBERTY BELL TRACTION is a layout that can simulate the expansion and growth of an actual interurban. You can start by modeling the LBT as a simple street railway on a plywood panel. This original line, contained within the city of Susquehanton, is laid out in figure-8 fashion and sports a couple of passing sidings, a carbarn, a spur to the dairy (one of the regular morning trains carries a special milk car to be dropped off at the dairy), and even a portion of private right of way.

The management of Liberty Bell Traction soon realizes that potentially there is extra business — and profits — in line expansion to smaller cities nearby. So the LBT streetcar line is extended to Cambria and Quakersburgh and becomes an interurban railway.

Quakersburgh (and Boroughsburgh across the Susquehanna River) can be built on another, smaller table. Although smaller than Susquehanton, Quakersburgh becomes the site of the main shops and yards of the newly expanded system. The new interurban service and increased local streetcar service for downtown Susquehanton justify a new, larger terminal building for LBT,

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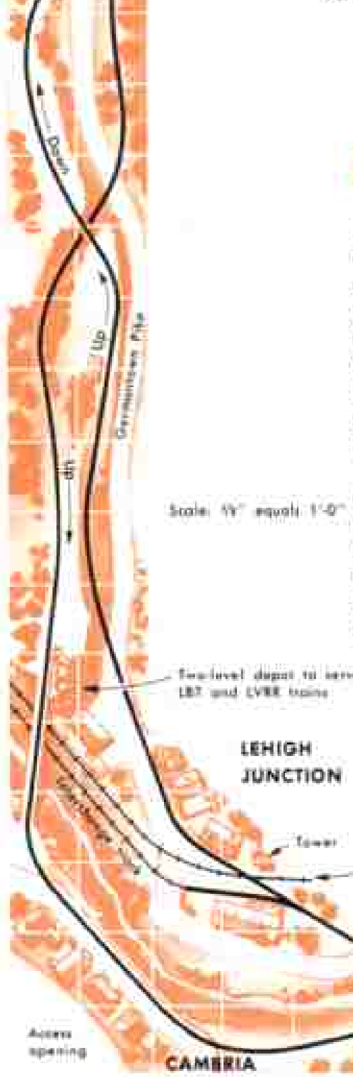
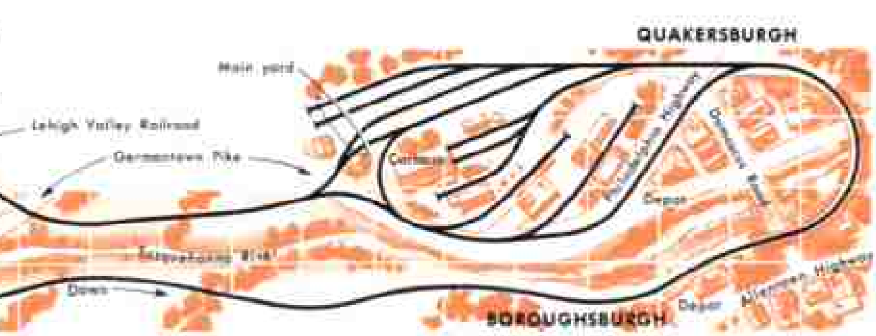




Liberty Bell Traction

Continued from page 117

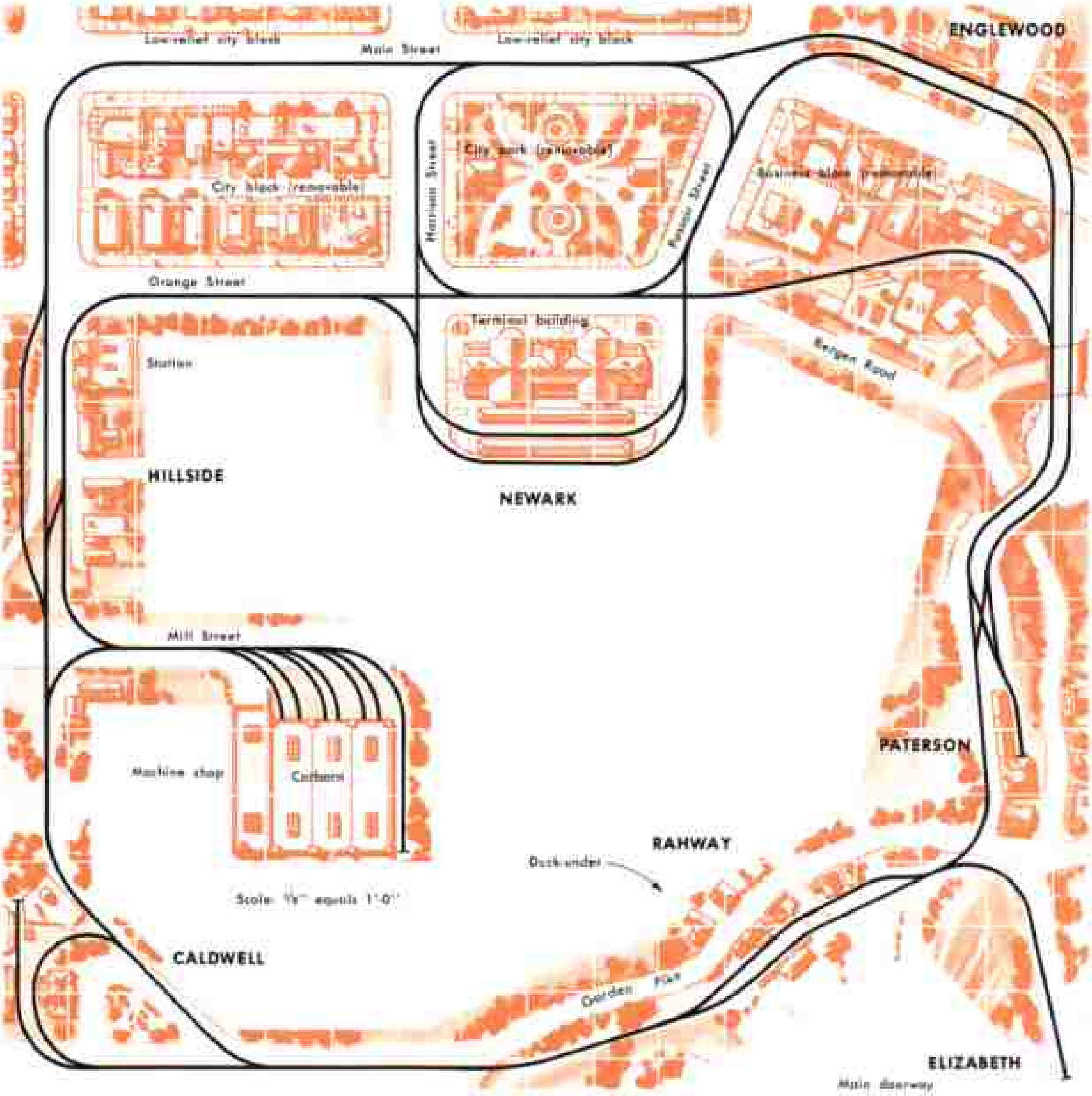
one that can be used by the local streetcars and by interurbans on the new line to Quakersburgh. The Susquehanton carbarn is moved to a location near the new passenger terminal on Market Street, and a freight terminal is constructed at Bethlehem Road and Lehigh Street.

The Lehigh Valley Railroad interchange with the LBT in Lehigh Junction provides our electric line with substantial freight business to Quakersburgh and to the new industries at Susquehanton that have opened since line expansion. Some freight movements through Susquehanton must negotiate the downtown streets, but Quakersburgh is lucky to have a freight-belt bypass around the city to keep rail traffic in its streets at a minimum.

Because of a sizable main line, the LBT can host long freight drags, multi-car commuter trains, and fast, named limiteds with parlor and lounge cars. Perhaps you could run your own version of prototype Lehigh Valley Transit's *Liberty Bell Limited* over the route of our LBT between Quakersburgh and Susquehanton, where connections are made with the lines's local streetcar service.

Around-the-room layouts

Combination shelf and table layouts are highly realistic

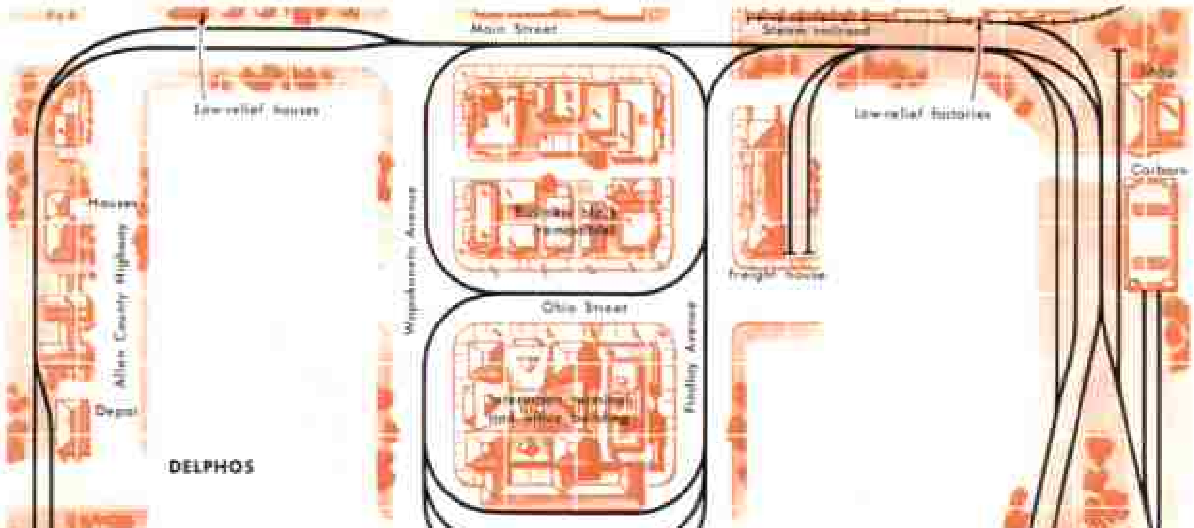


Public Service Traction

PUBLIC SERVICE TRACTION COMPANY is a layout for the traction modeler whose eyes light up at the mention of Eastern Massachusetts Street Railway, the Connecticut Company, or New Jersey Public Service. It offers a fine setting for deck-roofed Brill cars grinding along city streets, hitting an unaccustomed 30 mph on the shoulder of the county pike, and returning at day's end to a big multi-stall carbarn for a quick wash and running-gear inspection.

The PSTC is a multiple-route system designed so the routes can be combined in different schemes typical of the region. For example: The major routes of the Connecticut Company followed an end-to-end pattern, starting from the New York state line and running along the shore to New Haven, then heading north to Hartford and the Massachusetts state line. Routes of the Eastern Massachusetts Railway criss-crossed the area they served; routes of the New Jersey Public Service fanned out in different directions from the main Newark terminal. With the proper variation in station names, each pattern can be simulated on the PSTC. A study of the layout will reveal many possibilities.

In planning route patterns, note that the barn lead on Mill Street and both sides of the lap of track around the park — opposite Newark terminal — can be used as terminals along with the more obvious turnback facilities at Newark, Caldwell, Elizabeth, Paterson, and Englewood. Imaginative pairings of terminals will create a lot of operational variety. A small box-motor terminal has been included at Hillside so package freight or express service can be run.



Northern Ohio Light & Power Company

NORTHERN OHIO LIGHT & POWER COMPANY is typical of Midwestern interurbans that once laced Indiana, Ohio, Michigan, and Illinois. Two routes run in opposite directions from the city of Lima. The east extension terminates at Marion, while the western line runs through farmland to the small but important agricultural town of Van Wert. Suburban service also is operated on the Marion line between downtown Lima and the powerhouse just outside the city.

There is a large interurban terminal in Lima, freight houses in each terminal city, and even a steam-railroad connection. (Maybe the Northern Ohio is lucky enough to have an interchange agreement with this steam road; if so, watch out for that 48-foot curve on the main line in downtown Marion. More typically the connection would be limited to moving hopper cars of coal to the powerhouse.)

Mergers were a common practice in the interurban's golden age, so we're on safe ground in assuming the NO's two routes began life as independent companies. Let's call them the Lima, Marion & Eastern and the Lima Western to keep things straight. Cars on the suburban run to the powerhouse might be lettered for the Lima Traction Company for greater variety. This offers the brass hat some choice in lettering his cars and in the kind of service operated. He can model the period before the merger by lettering his smaller cars for the LW and his larger cars for the LM&E. Each group of cars would be restricted to runs between the appropriate cities, but perhaps as an indication that merger is just around the corner, one LM&E car might operate as a through limited between Van Wert, Lima, and Marion.

Or consider that the merger recently has taken place, but not all the cars have been relettered for the new company. What a grand mixture of colors and names could move through downtown Lima. There would be new, heavy cars lettered NORTHERN OHIO; older cars lettered LIMA, MARION & EASTERN and others LIMA WESTERN; plus a few city cars still lettered LIMA TRACTION. If each company has its own style of equipment and color scheme, we have a prototype justification for the variety many interurban modelers like to see on their layouts.

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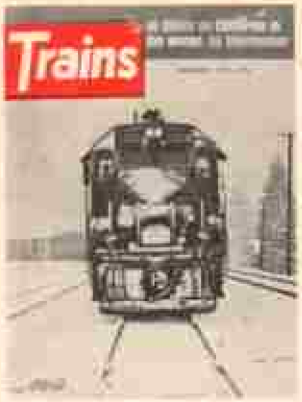

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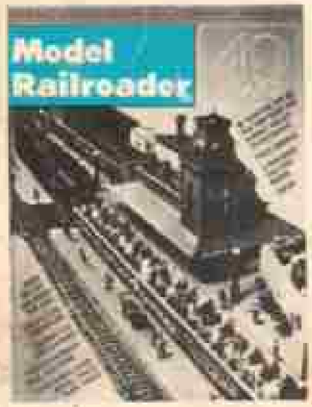

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